



FOURTH ANNUAL
R E P O R T
SAN FRANCISCO
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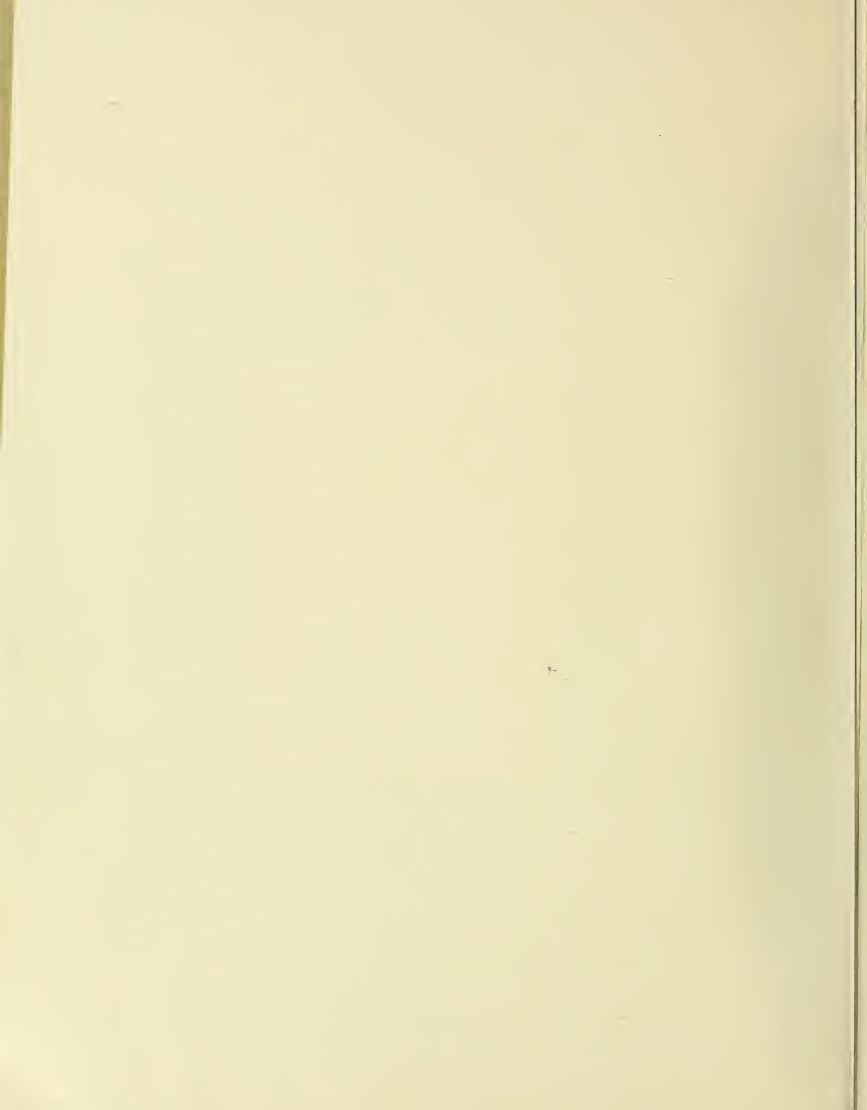
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1938

This copy of the Fourth Annual Report of the progress of construction as of July 1, 1937, of the San Francisco-Oakland Bay Bridge, which has been published to provide the authorities having interest therein with a complete record thereof, is issued to

Note —

⌘ This is Volume IV of a series of annual reports on construction progress and operation of the San Francisco-Oakland Bay Bridge.

⌘ Volume I contained material on legislation, financing, preliminary design, general description, and construction progress to June 30, 1934.

⌘ Volume II told of construction developments from July 1, 1934, to June 30, 1935.

⌘ Volume III continued construction progress from July 1, 1935, to June 30, 1936.

⌘ This volume carries through to completion the construction of the vehicular facilities of the bridge; develops construction on the electric interurban railway facilities; and includes a report of the operations and maintenance of the bridge from its opening November 12, 1936, to June 30, 1937.



FOURTH ANNUAL
PROGRESS
REPORT
SAN FRANCISCO
OAKLAND
BAY BRIDGE

.. JULY 1, 1937 ..

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GOVERNOR FRANK F. MERRIAM
Chairman, California Toll Bridge Authority

THE SAN FRANCISCO-OAKLAND BAY BRIDGE

Designed and Constructed by the DEPARTMENT OF PUBLIC
WORKS *of the* STATE OF CALIFORNIA *for the* CALIFORNIA
TOLL BRIDGE AUTHORITY



CALIFORNIA TOLL BRIDGE AUTHORITY: FRANK F. MERRIAM, *Governor*;
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Chairman, Highway Commission.

SAN FRANCISCO-OAKLAND BAY BRIDGE DIVISION OF THE DEPARTMENT
OF PUBLIC WORKS: EARL LEE KELLY, *Director*; C. H. PURCELL, *Chief Engineer*;
CHAS. E. ANDREW, *Bridge Engineer*; GLENN B. WOODRUFF, *Engineer of Design*.

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CONSULTING GEOLOGIST: A. C. LAWSON.

ATTORNEYS: HELLER, EHRLMAN, WHITE & McAULIFFE.



*West Bay, Looking
Looking Toward
San Francisco,
June 12, 1917*

Preface



It required eighty-five years of dreaming, discussion, and planning to bring the San Francisco-Oakland Bay Bridge to a point of actual construction; but it needed only three years and four and one-half months to build this masterpiece of modern engineering.

When the great span opened to traffic on November 12, 1936, and the first vehicle crossed over its broad decks, it inaugurated a new era for the San Francisco Bay Region and, indeed, for all the State.

It pioneered a new and modern highway linking two great centers of population, and provided for the first time a direct highway connection for transcontinental routes U. S. 40 and U. S. 50 through California to the Pacific Ocean.

The people of California may well be proud of this bridge, owned and operated by them without taxation, for none in the world surpasses it.

Frank F. Merriam

FRANK F. MERRIAM
Governor

*To His Excellency, FRANK F. MERRIAM, Governor of California,
and Members of the California Toll Bridge Authority*

GENTLEMEN:

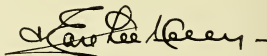
There is transmitted herewith the Fourth Annual Progress Report of Charles H. Purcell, Chief Engineer of the San Francisco-Oakland Bay Bridge. This volume describes completion of construction of the vehicular facilities of the bridge, start of construction of the electric interurban railway facilities, and discusses operations and maintenance of the span since its opening November 12, 1936, to June 30, 1937.

The report tells of the completion of one project (the structure proper), and the start of a second (the bridge railway), both of which are essentially correlated and inseparable.

It is the plan to continue annually the section on the report of operations and maintenance, which is initiated in this volume.

The State Department of Public Works is proud to submit the report of this work done under its direction.

Respectfully submitted

A handwritten signature in dark ink, appearing to read "Earl Lee Kelly", with a horizontal line drawn underneath the name.

EARL LEE KELLY
Director of Public Works

*To the Honorable EARL LEE KELLY, Director of Public Works
of the State of California*

SIR:

Submitted herewith is the Fourth Annual Progress Report of the San Francisco-Oakland Bay Bridge covering the period between July 1, 1936, and June 30, 1937.

For convenience this report is divided into three parts:

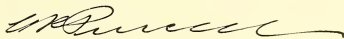
Part One deals with completion of contracts for the construction of the bridge and its vehicular facilities.

Part Two reports progress on the railroad facilities of the bridge.

Part Three discusses operations for the period extending from the opening to traffic on November 12, 1936, to the end of the fiscal year.

Contract No. 2, West Bay Substructure; Contract Nos. 4 and 4A, East Bay Substructure; and Contract No. 8, Concrete Girder Spans, which do not appear in this volume, were completed prior to July 1, 1936, and were discussed in Volumes I and II of the report.

Respectfully submitted



C. H. PURCELL
Chief Engineer



*Night View West
Bay Crossing,
November 11, 1936*

FOURTH ANNUAL
PROGRESS REPORT

. . . PART I . . .

BRIDGE CONSTRUCTION
[CONCLUSION]

San Francisco Cable Anchorage and Shore Piers

[[Contract No. 3]]

Progress July 1, 1936, to Completion

Cable Anchorage

By June 30, 1936, the Cable Anchorage had been completed to the level of the lower deck.

After this date work on the walls between decks and on the upper deck structure progressed rapidly. The roadway was placed by the contractor on Contract No. 6 during September and October. The entire anchorage, along with the remaining sections of Contract No. 3, described below, was accepted on December 5, 1936.

Viaduct

The viaduct section was completed, except for handrails, during the last fiscal year. (Refer to Volume III.) The railings were completed in August of 1936.

Piers "A," "B," and W-1

Piers "A" and "B" were completed in the second fiscal year and, except for concrete pilasters above the bridge deck, Pier W-1 was also finished during the same period. (Refer to Volume II.) These pilasters were completed in October and November of 1936.

Equipment

The equipment used on this contract was described in previous reports. A high standard of proportioning, mixing, and placing of concrete was maintained, and through the use of selected form material a high quality of concrete finish was achieved.

High Standard
Concrete

Personnel

This contract was held by the Healy-Tibbitts Construction Company, of which the late C. C. Horton was president, and Abe Cochrane, field superintendent. N. W. Reese was Resident Engineer for the State.

Summary

Contract awarded April 28, 1933. Work started June 14, 1933. Date of actual completion, November 10, 1936. Date of acceptance, December 5, 1936.

QUANTITIES

Excavation, unclassified.....	47,646.00 cubic yards
Anchorage steelwork.....	2,095,198.00 pounds
Concrete anchorage, mass concrete erection block.....	33,540.97 cubic yards
Concrete anchorage, mass concrete.....	32,644.72 cubic yards
Concrete anchorage, above lower deck.....	1,564.54 cubic yards
Concrete viaduct, footings.....	629.07 cubic yards
Concrete viaduct, above footings.....	8,491.62 cubic yards
Concrete railings.....	216.97 cubic yards
Concrete seal, Piers "A," "B," and W-1.....	4,275.34 cubic yards
Concrete above seal, Piers "A," "B," and W-1.....	14,143.18 cubic yards
Reinforcing steel.....	2,976,076.00 pounds
Miscellaneous metalwork.....	8,660.00 pounds
Cast iron drain pipe and fittings.....	53,294.00 pounds
Castings.....	16,033.00 pounds
Extra Portland cement.....	21.12 barrels

COST

Amount of contract prices.....	\$1,057,105.37
Total extra work.....	27,142.43
Total cost.....	<u>\$1,084,247.80*</u>

Total Cost

* This sum also includes electrical conduits and fittings and demolition of buildings.

Yerba Buena Island Anchorage, Piers and Tunnel

[[Contract No. 5]]

Progress July 1, 1936, to Completion

Status of Work, July 1, 1936

As previously reported, all major construction work on this contract had been completed, with a few minor exceptions, by the end of the last fiscal year. (Refer to Volume III.)

General

Erection of the anchorage balustrade was completed July 8, 1936. The handrail on the west viaduct was finished on August 5, 1936.

Waterproofing

In order to avoid the unsightliness resulting from leakage, it was decided to seal the construction joints in the roof of the Yerba Buena Island tunnel and upper deck sidewalls, as well as contraction cracks and grout holes, by a process of waterproofing. Three drillers, using thirteen-pound pneumatic hammers with ten-inch chisel steel and run by a 110 cubic-foot compressor, were employed in cutting a V-shaped groove in all joints and cracks. The grooves averaged about three and one-half inches in depth and about three inches in width at the surface, narrowing as the cut was deepened. In a few cases it was found necessary to cut to a depth of ten inches. Hammer and hand chisel were used to clean out loose fragments remaining after the drilling and the groove was then thoroughly brushed and washed at least twice for a final cleaning.

Materials and
Application

Materials used in waterproofing were high early strength cement and a proprietary metallic waterproofing agent consisting of sal ammoniac and iron filings. Other ingredients used were sea water cement, white cement, and river sand.

A neat mixture of one part cement to one part of the waterproofing agent mixed with water was painted into the cuts. Immediately following this application a waterproofer applied a standard waterproofing mix of two sacks of river sand to one sack of cement to two and one-half gallons of water, in addition to 25 to 35 pounds of the waterproofing agent. This mix was applied by trowel in layers not over one-half inch in depth and allowed to set. After the mix had set up, the surface was again cleaned with a wire brush and painted with the neat mix outlined before. A second one-half inch of the standard waterproofing mix was then applied.

The maximum depth of waterproofing applied in one day was about one inch. The waterproofing procedure was continued until the cut section had been filled to within one-quarter inch of the top of the cut on the roof surface. Then a patching mix, using sea water cement, blended with white cement, was applied to complete the waterproofing operation.



Yerba Buena Island
Tunnel at Night,
November 11, 1936

Average progress per day ran about 118 linear feet of joint cut-out to about 78 linear feet of joint waterproofed. The crew employed consisted of three drillers, two waterprooferers, and two waterproof helpers.

Personnel

The contract for this work was held by Clinton Construction Company, of which W. B. Brinker is president and Albert Humber, vice president. Lieutenant Commander Collins Macrae, U.S.N., and Lieutenant H. A. Bolles, U.S.N., represented the Commandant of the Twelfth Naval District. Harry Carter was Resident Engineer for the State.

Summary on Contract No. 5

Contract awarded April 23, 1933. Work started May 15, 1933. Date of actual completion, December 21, 1936. Date of acceptance, December 28, 1936.

QUANTITIES*

Excavation, unclassified	374,541.50 cubic yards
Anchorage steelwork	2,772,557.00 pounds
Concrete anchorage foundations	3,078.00 cubic yards
Concrete anchorage, above foundations	11,560.55 cubic yards
Concrete viaduct and wall footings	2,137.87 cubic yards
Concrete viaduct and wall, above footings	11,366.18 cubic yards
Concrete railings	216.66 cubic yards
Concrete foundations, Piers YB-2 to YB-4 and E-1	3,975.89 cubic yards
Concrete above foundations, Piers YB-2 to YB-4 and E-1	9,949.80 cubic yards
Concrete sidewalks, curbs and gutters	456.14 cubic yards
Crusher run base	1,685.43 cubic yards
Crushed stone surfacing	1,301.23 cubic yards
Fuel oil	46.14 barrels

Cut-back asphalt	82.57 tons
Reinforcing steel	5,792,620.00 pounds
Miscellaneous metalwork	27,604.00 pounds
Concrete pavement, lower deck	1,470.03 cubic yards
Cast iron drain pipe	135,050.00 pounds
Castings	16,924.00 pounds
Portland cement, roof grouting	2,612.00 barrels
Jet drilling	155.90 linear feet
Diamond drilling	112.50 linear feet

*These quantities do not include anchorage tunnels, tunnel construction, electric conduits and fittings, nor drain tile; but these items are included in the cost.

Total Cost

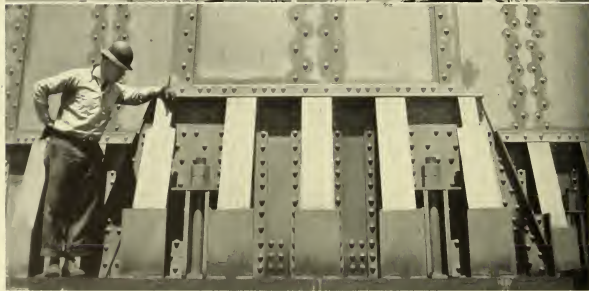
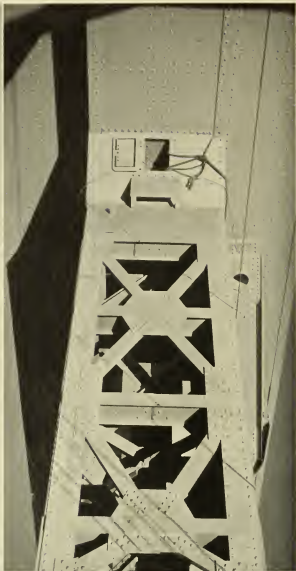
COST

Total contract cost	\$1,988,568.63
Total extra work orders	363,639.41†
Total expenditures	\$2,352,208.04

†This high percentage of extra work arose from contract provisions requiring that removal of buildings, utility changes, etc., made on Yerba Buena Island were to be handled under extra work orders.



*West Portal, Yerba
Buena Island Tunnel,
May 14, 1937*



*Upper left:
Expansion Rocker
for Stiffening Truss
at Towers*

*Upper right:
Lower Deck Stent
at Towers*

*Lower:
Section Showing
Tower Anchorage*

West Bay Superstructure

[[Contract No. 6]]

Progress July 1, 1936, to Completion

Status of Work, June 30, 1936

At the start of the fiscal year this project was 94 per cent completed. There remained the placing of approximately 2,000 tons of steel; the driving of 228,000 field rivets; and the pouring of 18,000 cubic yards of concrete.

General

Chronologically, work from July 1, 1936, to the opening of the bridge on November 12, 1936, proceeded as follows: Chronology

- July 10—* Cable wrapping for the west half of the suspension spans was completed except for San Francisco backstay.
- July 13—* Steel hood enclosing the A-frame and eyebars at the Center Anchorage was completed.
- July 14—* Start was made on the erection of the hood at Tower W-2 and on the same day cable wrapping was begun for the east half of the suspension spans.
- August 12—* The last major piece of steel was erected with the closing of the truss at Bent 1.
- August 25—* Cable wrapping was completed on the east spans less than one month after its start.
- September 3—* With completion of the steel hood at Tower W-6, steel erection on the bridge's four towers was finished.
- September 4—* Cable wrapping was completed on the San Francisco backstay, marking the finish of all machine wrapping on the cables.
- September 12—* The last of the tower rivets was driven.
- October 7 to 20—* Concrete for the hood at the Center Anchorage was poured.
- October 13—* The last of the catwalk on the east suspension spans was removed.
- October 14—* All concrete paving was completed.
- October 22—* The catwalk was removed from the west suspension spans.
- October 23—* The last rivet was driven on the stiffening trusses.

*Placing Last Floor-
beam at San Francisco
Anchorage,
August 28, 1936*



Cable Wrapping

On June 30, 1936, cable wrapping was 44 per cent completed for the entire suspension bridge.

Low points on east and west sections of the suspension spans had been wrapped by May 28, this early wrapping having been permitted with the understanding that re-wrapping due to cable deformations might be required. Three panels on the north cable and two on the south cable west of the Center Anchorage were later re-wrapped due to such causes.

With the addition of structural loads, major wrapping had started, with the schedule as of July 1 as follows:

West Suspension Spans: General wrapping to July 10; Span 0-1, west half, August 26 to September 4.

East Suspension Spans: General wrapping July 14 to August 25.

Although wire wrapping was included under Contract No. 6, cleaning and application of cable paste was carried on under the Painting Contract No. 9.

Wrapping Machine

From 325 to 350 pounds of galvanized wire was carried on each of the three spools of the wrapping machine, so that it was possible to wrap a full panel between cable bands with each spool.

Two modified wrapping machines were used, working up the cable. Each was driven by a ten-horsepower motor. Maximum rate of wrapping for one machine was 8 panels (approximating 224 linear feet) in one eight-hour shift.

Kinks in the wire were eliminated by passing over straightening rolls attached to the wrapping machine. These rolls were also placed on hand-wrapping equipment, which was utilized in sections of the cable where lack of space did not permit a machine.

Straightening Rolls

Center Anchorage

With the erection of the steel hood at the Center Anchorage (Pier W-4) on July 13 and the pouring of the last concrete for the A-frame work on October 20, construction work on this section was complete.

A total of 1,808 cubic yards of six sack concrete was poured into the hood.

Catwalks

Following completion of cable wrapping and with the final tightening of band bolts the catwalks were removed. This was accomplished by cutting the catwalk at panel points into thirty-foot lengths, and lowering to the deck. From there it was hauled away to be sold eventually by the State.

Removing Catwalks

Riveting

Riveting on the suspended span was correlated to paving and painting and the proper erection stages for the closure of joints.

As a rule riveting was kept ahead of paving and painting demands. Lower chord joints were under compression and could be riveted when crews were available. (Refer to Volume III.)

While the major portion of the riveting was completed by the start of the fiscal year, there remained some top and bottom chord and miscellaneous riveting, the last of which was completed on October 23, twenty days before the opening of the bridge to traffic.

Riveting Schedules

An average rate of 228 rivets per eight-hour gang day were driven on the suspended spans. Maximum rate for the bridge during one week was 45,368 rivets driven in 187 eight-hour gang days.

Concrete

With 18,000 cubic yards of concrete remaining to be placed at the start of the fiscal year, July 1, 1936, all roadway paving was completed by October 14, 1936.

Maximum rate of single lane upper deck paving was 815 linear feet per eight-hour day, requiring 297 cubic yards of concrete. Average daily rate per single lane was 568 feet per day.

Paving Schedules

On the lower deck paving operations reached a maximum of 512 linear feet per eight-hour day, requiring 320 cubic yards of concrete. The average daily rate on this deck was 386 feet.

A total of 11,584 cubic yards of paving was used on the upper deck and 6,320 cubic yards on the lower deck. The amount of welded reinforcing trusses and reinforcing steel used totaled 3,112 tons.

Specifications required that forms for the concrete paving were not to be placed until ten days before the estimated date for pouring, and were to be removed six days after the paving was placed.

Use of lightweight aggregate on the upper deck roadway resulted in a weight saving of 25 pounds per square foot, or 1,450 pounds per linear foot. This reduction materially decreased the dead load stresses in the cables and towers, thus reducing the area and the cost of its structural members.

Lightweight Aggregate

Because of the allowance in design for two tracks on the lower deck, paralleling a three-lane concrete roadway, it was determined that the benefits from a lightweight pavement on this deck would be comparatively slight since the combination concrete slab and truck loading produces approximately the same square foot loading as that of the interurban trains and timber floor. Thus a balance on the load of the two trusses is accomplished.

The upper deck roadway, restricted to the use of light vehicular traffic, is designed for H-10 loading, as against an H-30 loading on the lower deck.

Heavy and constant traffic over both decks since the opening of the bridge has produced no ill effect on the paving. Probably the most severe test to which the paving will ever be subjected occurred before the bridge was opened to traffic when an oxygen tank weighing 150 pounds slipped from a hoist at the top of Tower W-5 and fell 240 feet to the roadway. Only damage was the shattering on an 18-inch square area in the pavement.

Personnel

The contract for the superstructure of the West Bay Crossing was held by the Columbia Steel Company, of which Ambrose Diehl is president. J. R. Fox was contract manager. The steel was fabricated and erected by the American Bridge Company, of which C. S. Garner was general manager of erection; and H. C. Hunter was western erecting manager. I. O. Jahlstrom was Resident Engineer for the State.

Summary

Contract awarded April 28, 1933. Work started February 26, 1934. Date of actual completion, February 2, 1937. Date of acceptance, February 5, 1937.

QUANTITIES

Silicon steel in towers	33,628,319.00 pounds
Carbon steel in towers	11,401,960.00 pounds
Cast steel in towers	1,146,462.00 pounds
Heat-treated eyebars	713,916.00 pounds
Carbon steel eyebars	702,484.00 pounds
Nickel steel	578,998.00 pounds
Silicon steel, suspended structure	50,997,378.00 pounds
Carbon steel, suspended structure	32,410,681.00 pounds
Cast steel, suspended structure	254,672.00 pounds
Manganese steel rivets, suspended structure	7,364.00 pounds
Phosphor bronze, suspended structure	50,124.00 pounds
Lightweight concrete paving, upper deck	11,583.83 cubic yards
Concrete paving, lower deck	6,320.40 cubic yards

Reinforcing trusses, upper deck	713,240.00	linear feet
Reinforcing trusses, lower deck	477,701.00	linear feet
Reinforcing steel	2,243,767.00	pounds
Concrete completion of center anchorage	1,808.20	cubic yards
Portland cement	30,380.14	barrels
Cable wire	38,229,232.00	pounds
Cable castings	1,958,867.00	pounds
2 1/4" suspender ropes	218,898.62	linear feet
1" hand ropes	37,924.60	linear feet
High tensile bolts	182,240.00	pounds
Wrought shims	42,166.00	pounds
Galvanized cable fastenings	49,698.00	pounds

COST

Total contract cost	\$13,990,428.76
Total extra work orders	494,196.44
Total expenditures	<u>\$14,484,625.20</u>

Costs

East Bay Superstructure

[[Contract No. 7]]

Progress July 1, 1936, to Completion

Status of Contract, June 30, 1936

At the end of the fiscal year, June 30, 1936, work on this contract was 99.8 per cent completed. Aside from general cleaning, only a few minor items remained to be done.

General

The cleanup work included the dismantling and removal of all scaffolding; cleaning of the steel structure and piers; spot painting; and the cleaning and sweeping of both decks. It involved also the removal of the mixer dock on the Key Route Mole.

Construction

Only construction work remaining as of June 30, 1936, was the erection of a concrete traffic nose on the lower deck at Pier E-25, designed to separate east and westbound traffic. The work was accomplished under Extra Work Order No. 29. Also under this order was the removal of felt expansion joints on the lower deck. These joints were then cleaned and filled with cement grout.

Due to anticipated settlement it was necessary to jack up Spans 36, 37, and 38 approximately 5½ inches. Seventy-ton screw jacks were used under each girder and an average force of 12 men was sufficient to complete the job in approximately ten days.

Repair of the damage caused by a fire at Pier E-3 in April of the last fiscal year was started September 1 by the American Bridge Company and completed January 20, 1937. The burned timber fender was stripped; burned concrete chipped; apron and pier gunited; and plastic waterproofing placed before the new timber fender was erected.

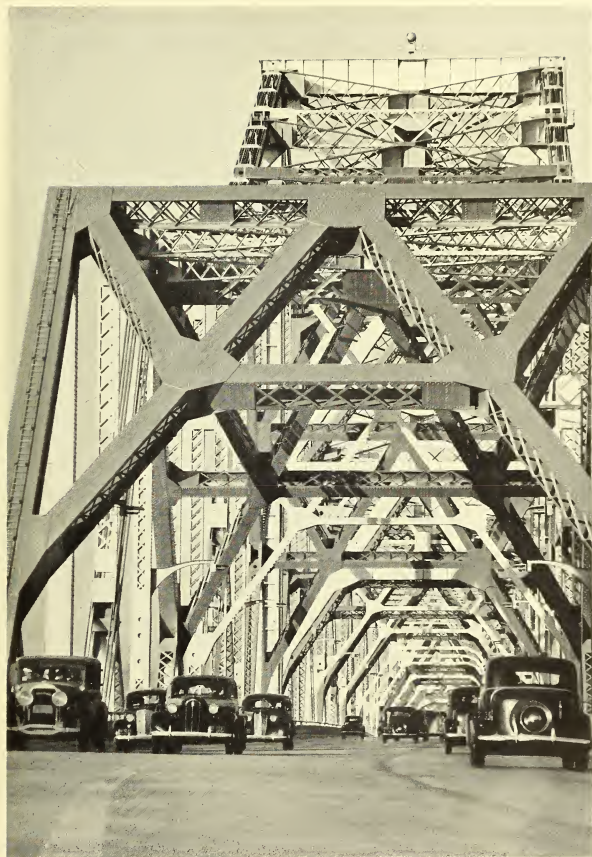
Pier Fire Damage

Personnel

The personnel on this contract was identical with that of Contract No. 6, except that V. A. Endersby was Resident Engineer for the State.

Summary

Contract awarded April 28, 1933. Work started July 30, 1933. Date of actual completion, August 3, 1936. Date of acceptance, September 8, 1936.



*Cantilever Span,
East Bay Crossing,
May 14, 1937*

QUANTITIES CONTRACT NO. 7

Nickel steel in spans	7,151,596.00	pounds
Silicon steel in spans	50,624,624.00	pounds
Carbon steel in spans	38,203,146.00	pounds
Heat-treated eyebars	9,632,639.00	pounds
Silicon steel in bents	6,102,851.00	pounds
Carbon steel in bents	9,113,609.00	pounds
Manganese steel rivets	168,023.00	pounds
Phosphor bronze	732.00	pounds
Lightweight concrete paving, upper deck	11,977.48	cubic yards
Concrete paving, lower deck	6,462.89	cubic yards
Reinforcing trusses, upper deck	938,749.87	linear feet
Reinforcing trusses, lower deck	373,602.56	linear feet
Reinforcing steel	1,743,560.00	pounds
Portland cement	30,585.67	barrels

COST

COSTS	Total contract cost	\$9,057,518.87
	Total extra work orders	161,783.15
	Total expenditures	\$9,219,302.02

Painting West and East Bay Superstructures

[Contract No. 9]

Progress July 1, 1936, to Completion

Status of Work, June 30, 1936

At the end of the fiscal year, June 30, 1936, work on this contract stood as follows:

West Bay Crossing: All towers and bents had received their fourth and final coats of paint. Placing of cable paste was within 98 per cent of completion. The second coat on the suspender ropes was 98 per cent completed and the fourth coat had been started. The second coat on the spans was 99 per cent completed, and work on miscellaneous steel—including tower hoods, anchorages, walks and inspection bridges—was under way.

East Bay Crossing: Second coat on the cantilever span was 75 per cent completed, while the fourth coat on the Yerba Buena steel bents was 50 per cent completed.

General

Work on this contract was necessarily coordinated with progress on steel construction and paving schedules. Painting on the East and West Bay Crossings was for that reason not completed until after the opening of the bridge to traffic, although schedules were arranged to finish all work that would interfere with or endanger traffic as it moved across the upper and lower decks. In all, a total of approximately 146,000 tons of steel was painted.

Discussions of methods employed under this contract may be found in Volumes II and III of these reports and are concluded herein.

West Bay Crossing

In the following table major dates are given, showing start and completion of painting operations on the West Bay Crossing subsequent to July 1, 1936:

Cable paste completed September 3, 1936.

Cables and attachments

Second coat started August 17, 1936; completed December 10, 1936.

Third coat started August 31, 1936; completed January 5, 1937.

Fourth coat started September 21, 1936; completed February 5, 1937.

Suspender cables

Second coat completed August 7, 1936.

Third coat completed October 19, 1936.

Fourth coat completed November 9, 1936.

Painting Schedules,
West Bay Crossing



*Aerial View Showing
1915 Street Approach,
October 23, 1936.*

Spans

Second coat completed July 25, 1936.

Third coat completed January 10, 1937.

Fourth coat started October 15, 1936; completed February 23, 1937.

Miscellaneous steel as

Hoods, towers, anchorages, walks, inspection bridges; completed March 4, 1937.

INTERIOR SURFACES

Surfaces of tower and closed chord interiors were painted by hand brushes due to the adverse effects on workmen through the use of sprayed paint in confined areas.

Approximately three to four months were allowed between second and third coats for the interior painting of the towers, and not less than a one month interval was permitted between the application of the third and fourth (aluminum and final) coat.

Satisfactory treatment of interior surfaces of the closed chord sections required intervals of from two to three months between successive second, third and fourth coats.

Interior surfaces of towers and of the braces between tower legs were painted without a special scaffolding other than planks. Electric lights were used for purposes of illumination.

It is worthy of note that hand brush paint application on interior tower surfaces involved about two-thirds of the area covered on the towers.

TOWER EXTERIORS

The exterior surfaces of the towers were painted by air brush, followed by hand brushing where necessary.

Painters worked from swinging platforms especially constructed to fit the shape of the tower legs. Platforms were elevated or lowered by cables attached to needle beams at the tower tops and operated by engines on the pier deck.

CABLE PASTE

Cable paste was applied by brushes ahead of cable wrapping. (Refer to Contract No. 6, page 22.) Actual coverage of cable paste was 9.2 linear feet to a gallon, or 74 square feet per gallon. Before application of the paste wires were first cleaned with mineral spirits. Only sufficient paste for the day's wrapping was applied. Close attention was given to the application of the paste, and wherever a thin place was revealed in the paste coat just ahead of the wrapping machine, a second coat was applied by the painters. Removal of the temporary seizing wires just prior to wrapping exposed untreated spaces which also required a special application of paste.

MAIN CABLES AND ATTACHMENTS

Paint for the main cables and attachments was applied by hand brush. This work was done from portable trussed planks, one on each side of the cable, supported by hangars attached to the hand rope cables.

Hand Brush Painting

Air Brush Painting

Wrapping Wire
Treatment

*Painting Operations,
West Bay Crossing,
October 21, 1936*



Painting of the cables followed closely after the wrapping machine. Work was made immediately possible because of the application of a copper sulphate solution to the wrapping wire which provided a satisfactory substitute for the specified three months weathering.

The solution had been mixed at the spooling plant in a hundred-gallon tank. A fresh hundred-gallon solution was made for each day's run sufficient to treat approximately 14,000 pounds of wire. The wire was immersed in the solution, removed, and immediately washed with fresh water and placed on drying racks. A ten seconds immersion in a fresh solution on the following morning and a final sixty seconds immersion at the end of the day completed the treatment.

Cables over the saddles at the towers were given four coats of red lead paint rather than the three lead coats and aluminum paint applied to the balance of the cables.

Areas covered on the main cables per gallon were: first coat, 338 square feet; second coat, 427 square feet; third coat, 467 square feet; and aluminum coat, 410 square feet.

SUSPENDER CABLES

Paint for the suspender cables was also applied by hand brush except for the six or seven feet immediately above the truss chords. This portion was painted by air brushes simultaneously with upper chord painting.

Prior to painting, the suspender cables were first cleaned with mineral spirits. Paint coverage on the suspenders averaged per gallon as follows: first coat, 175 linear feet; second coat, 243 linear feet; third coat, 303 linear feet; and aluminum coat, 281 linear feet. The number of square feet covered per gallon was for the successive coats, first to final, 143, 198, 247, and 229 square feet respectively.

The suspender cables were painted from boatswains chairs.

*Paint Quantities,
Suspender Cables*



*Painting Operations,
East Bay Crossing,
October 21, 1936*

SPANS

Suspension spans of the West Bay Crossing were painted primarily by air brush. Although from 35 to 50 per cent of hand brushing was necessary for the second and third coats due to glossiness of surface, approximately 75 per cent of the continuous spans was painted by hand brush.

Difficulties were encountered in attempting to paint steel that was slightly warmer than the specified lower limit of 35 degrees Fahrenheit. Experience indicated a minimum limit for satisfactory results of 50 degrees.

*Temperature
Conditions*

During warm dry weather intervals of fourteen days between application of coats on exterior surfaces were found to be satisfactory. The shorter intervals, however, between coat applications resulted in necessity for considerable hand brushing. (Refer to Volume III.)

Two major types of equipment, special traveling gantries and steel inspection bridges, were used for span painting.

Equipment

The gantries, which ran along the lower deck curbs, were sufficiently high at the center to clear vehicles and were large enough to permit occupancy by six spray painters. From the gantries upper deck steel members were painted.

Lower deck steel members were painted from the permanent inspection bridges operated below this deck.

Determined to complete painting of all steel above roadways of both decks by opening of the bridge to traffic on November 12, 1936, exceptional painting records were achieved. In one week or less, one coat was applied to half a main span; in length equivalent to approximately 1,155 linear feet. With the average rate of paint application half the amount, a single air brush man applied as much as eight to ten gallons of paint per eight-hour day, including the time required for necessary hand-brushing.

*Painting Main Cables,
August 8, 1936*



Second, third and aluminum coats averaged per gallon 595, 622, and 545 square feet respectively.

Final painting on the West Bay Crossing was completed March 10, 1937.

East Bay Crossing

As described in Volume II, paint for the spans of the East Bay Crossing was applied largely by air brush followed by hand brushing. Exceptions were the lacing bars of all laced members, and the interior of boxed members and tower legs, where hand brushing was used.

*Painting Schedules,
East Bay Crossing*

The aluminum coat remaining to be completed was applied entirely by air brush except for the YB bents which required brushing.

By August 7, 1936, the second coat had been completed on the East Bay spans.

The third coat had been applied by October 2, 1936, and by the opening of the bridge all painting equipment had been removed from the decks.

Painting, however, on these spans was not completed until February 22, 1937.

Personnel

Contract for this work was held by Bridge Builders, Inc., of which Henry J. Kaiser was president. E. H. Connor was managing engineer. H. B. Watson was the subcontractor. I. O. Jahlstrom was Resident Engineer for the State on the West Bay Crossing; and V. A. Endersby was Resident Engineer for the State on the East Bay Crossing.

Summary

Contract awarded November 14, 1934. Work started December 16, 1934. Date of actual completion, March 10, 1937. Date of acceptance, March 19, 1937.

QUANTITIES

<i>Paint</i>	CONTRACT NUMBER				
	<i>Coat No.</i>	<i>*6-6A Gallons</i>	<i>*7 Gallons</i>	<i>9 Gallons</i>	<i>Total Gallons</i>
Cable paste.....	--	40		2,020	2,060
Red lead.....	1	15,900	13,600	1,900	31,400
Red lead.....	2	2,700	570	20,700	23,970
Red lead.....	3			22,100	22,100
Black (Graphite).....	3	130	70		200
Black (No. 35).....	4			250	250
Yellow.....	4			300	300
Aluminum.....	4			24,600	24,600
Totals.....		18,770	14,240	71,780	104,880

*Quantities include paint for spot painting, painting over reblasted steel, etc.

COST

	<i>West Bay Crossing</i>	<i>East Bay Crossing</i>	<i>Total</i>	<i>Costs</i>
Total contract cost.....	\$504,723.17	\$349,510.09	\$854,233.26	
Extra work orders.....	18,080.46	15,133.14	33,213.60	
Total expenditures.....	\$522,803.63	\$364,643.23	\$887,446.86	

Administration Building and Toll Plaza

[[Contract No. 10]]

Progress July 1, 1936, to Completion

Status of Work, June 30, 1936

All phases of design and construction have been described in Volume III.
Remaining major items to be completed as of June 30, 1936, were:

	<i>Per cent Complete</i>
Administration building, general construction.....	94
Toll booths and canopies, general construction.....	42
Truck scales.....	50
Heating and plumbing.....	95
Electrical work.....	68

Administration Building, General Construction

Aluminum Work
Delayed

At the close of the last report aluminum work, wall coverings, floor coverings, painting, and installation of the clock system were incomplete. The aluminum work had been delayed by changes in plans, and delivery from an eastern factory for many of the pieces had to be awaited. This item was sufficiently complete for occupancy of the building in October. It was finally completed November 9, 1936.

Toll Booths and Canopies

Adjustment of
Electrical Work

Considerable delay was caused in awaiting delivery of aluminum material for the canopy ceilings from the factory. The intricate electrical work and mechanism of axle counters, overhead indicators, and tariff indicators required a large amount of correction and adjustment.

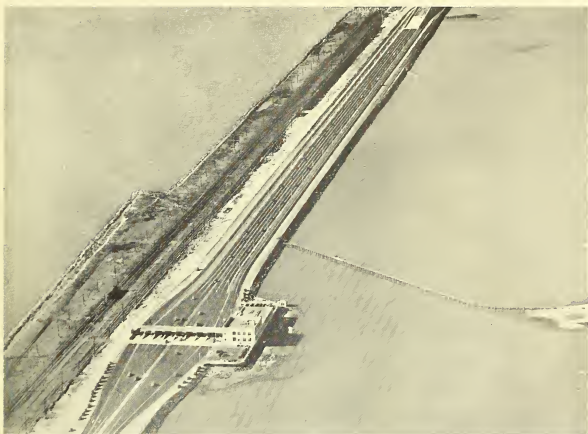
By working all night before opening day this work was ready in time. It was also found necessary to make changes and adjust electrical recording devices under working conditions.

This item was complete November 23, 1936.

Truck Scales

The four truck scales were tested by the Sealer of Weights and Measures of Alameda County, under standard loads from 100 pounds up through various increments to the capacity of the scale. After a few minor adjustments, they were pronounced correct and a certificate issued.

Truck scales were accepted as completed November 9, 1936.



*Uppers:
Aerial View of
Administration
Building and
Toll Plaza,
December 1, 1936*

*Lower:
Looking East Toward
Administration
Building and
Toll Plaza,
October 28, 1936*

Boiler Doors
Replaced

Heating and Plumbing

When installation of the boilers was completed, the boiler doors and clean-out door to the stack were found to be warped, thus admitting air and causing an improper draft. These doors had to be replaced.

Steam return lines in basement and tunnel were not properly sloped. Hence, condensate collected in the lines, shutting off return to the boilers. With rectification of this deficiency the system was placed in excellent operating order. This item was completed December 8, 1936.

Fire Alarm System
Synchronized

Electrical Work

This, like previous items, had to be carefully checked and adjusted to working conditions. The general fire alarm system was synchronized with the system on the bridge and connected with that of the cities of Oakland and San Francisco. Last-minute adjustments also had to be made to the clock system. This item was completed December 8, 1936.

Personnel

The work under this contract was done by the Clinton Construction Company, general contractors. V. A. Endersby was Resident Engineer for the State.

Summary

Contract awarded July 31, 1935. Work started July 31, 1935. Date of actual completion, December 10, 1936. Date of acceptance, December 14, 1936.

QUANTITIES

(In addition to general building construction)

Excavation.....	12,620.00 cubic yards
Driving timber piles.....	651.00 each
Concrete seal.....	492.04 cubic yards
Foundation concrete.....	1,159.76 cubic yards
Structural concrete.....	2,067.59 cubic yards
Concrete railings.....	35.96 cubic yards
Reinforcing and miscellaneous steel.....	568,255.00 pounds
Selected base material.....	1,774.10 cubic yards
Crusher run base.....	1,497.11 tons
Asphalt concrete.....	1,966.86 tons
Extra Portland cement.....	74.90 barrels

COST

Total contract cost.....	\$345,800.68
Total extra work orders.....	7,255.59
Total expenditures.....	*\$353,056.27

* This total includes waterproofing; two 30-foot 30-ton truck scales; two 60-foot 40-ton truck scales; general construction Administration Building; general construction toll booths and canopies; heating and plumbing; electrical work; steel furniture and flagpoles.

Electrical Work

[[Contracts Nos. 11-11A]]

Progress June 30, 1936, to July 1, 1937

Status of Work, June 30, 1936

As of June 30, 1936, this contract was approximately 55 per cent completed. Distribution cable, control cable, and roadway lighting cable was practically complete from the Distribution Structure in the East Bay to Pier E-4. The lighting standards were partially erected. Roadway lighting circuits and lighting standards were completed in sections of San Francisco approaches.

Work on Substations 5 and 6, at the Administration Building and East Bay Distribution Structure, had been completed to an advanced stage. No work had been done on Substations 1, 2, 3, and 4. The work on communications, navigation lights, beacons, and fog signals had only been started.

The noncompletion of the structural steel contracts on the West and East Bay Crossings prior to this date had made work impossible in large sections between E-4 and San Francisco approaches.

General

As work progressed on structural steel contracts during the early fall of 1936, it became obvious that the electrical contracts could not be completed by the time of the opening of the bridge, November 12, 1936.

During the remaining two months operations were carried on at the same time and in coordination with operations of other contractors. The goal attempted was to complete all of the work possible in a permanent manner, and to have roadway illumination by the opening day in the best condition possible. Immediately before the opening day all roadway lighting circuits were operating.

Coordination of Work
With Contractors

Substations

Although substation installations were not entirely completed by November 12, 1936, all equipment was in place and all electrical connections were finished by that date.

Final dressing up and a few connections were remade during the winter and spring of 1937.

These substations were described in Volume III. A description of cables, lighting, and other items will also be found in that report.

Cables

At the time of opening there were in use a few thousand feet of temporary cable, merely laid along the railing to connect electrically incompletd circuits.

*
Cables Placed on
Upper Chords

The installation of cables on the West Bay Crossing was made in a remarkably short time. They were placed directly on top of the upper chord of the stiffening truss structures.

Subsequent to opening day, November 12, 1936, through a separate authorization, the State, under day labor, boxed these cables in a redwood trough. This affords better protection to the cables and allows the top surface of the steel to be properly maintained.

The cables, other than on the West Bay Crossing, had been largely installed prior to the opening day of the bridge.

Roadway Lighting

In the East Bay the actual installation of roadway lighting units was delayed until the time of operation to minimize the breakage resulting from public curiosity and mischief. The installation of the units on the main bridge was necessarily delayed until other items were completely installed. In order to complete the installation, it was necessary to operate on a two-shift basis for several weeks. Other work, as required, was executed at night.

Sodium Vapor
Lighting Described

The use of the sodium vapor lighting units has produced a uniformity of light distribution and excellent visibility without glare. The high mounting, combined with low brilliancy and the apparent softness of the light, eliminates noticeable flicker as the motorist passes the adjacent luminaires.

Economies of Lighting

For light traffic conditions a satisfactory illumination is obtained from the use of alternate circuits. While the roadway is very definitely patterned, there has not as yet been any apparent criticism because of the reduction in uniformity. Present traffic conditions indicate that full lighting will be used until midnight and half lighting for the rest of the night. The determining factor is not so much the cost of the energy consumed as the saving in lamp replacement costs.

Percentage of Life

The area traversed by the bridge is subject to heavy fogs. A road speed of 45 miles per hour can be maintained during fogs of average density with a reduction of not more than 10 miles per hour during the heaviest fogs. This compares well with an average speed of five to 10 miles per hour, and a feeling of much uncertainty, on unlighted or poorly lighted streets and roads adjoining the approaches. Pavement reflection during rainy weather is also reduced.

A very high percentage of the sodium vapor luminaires has exceeded a guaranteed life of 2,000 hours. One isolated case operated for 5,800 hours. Some corrosion of the aluminum reflecting surfaces of the luminaire units has been noted. The solution of this problem has not been reached.

For maintenance and operation, refer to "Electrical Maintenance," page 88. For Lighting Installation of Legislative Approaches, see "Electrical Work on Approaches," page 55.

Navigation Lighting

The installation of red and white pier lights, white and green channel lights, and revolving and flashing beacons, was carried forward and completed before pier and beacon warning lights used during construction were removed.

Shortly after the installation was completed the syncro-tie systems used for maintaining synchronism of the rotating beacons on both sides of the bay proved



*Testing Lights,
East Bay Crossing,
November 10, 1936*

faulty. The original set-up consisted of a transmitter (synchronous generator) for each group, and a syncro-tie receiver (synchronous motor). Both the receivers and transmitters burned out after a short operating period. After repairs, shop tests showed inherent difficulties. The solution was merely to replace the receivers with synchronous induction motors, which operate off a common source of power. These have given satisfactory results.

Synchronous Induction
Motors

Fire Alarm and Tow-Car Call System

The purpose of the system is to enable the traveling public, bridge crew, or the Highway Patrol to summon assistance in the event of a fire or other trouble, such as disablement of trucks or automobiles, gasoline shortage, or flat tires.

Function of Boxes

The system extends from the west end of the bridge proper to Pier E-23 at the east end. There are sixteen locations for call boxes, about 1,200 feet apart, on the north side of both the upper and lower decks, giving a total of 32 boxes. These boxes are at corresponding locations on each deck, except at the west end where the box on the upper deck is located at Pier W-1, and the box on the lower deck at the San Francisco anchorage.

Tow-Car Call
Boxes Located

Each box is equipped with two break-glass switches for public use and a telephone jack. One break-glass switch serves to call a tow car and the other the Bay Bridge's own fire truck. The fire alarm switch is furnished with a presignal switch to be operated by a special key in possession of authorized persons. The function

of the presignal switch (not to be confused with the break-glass fire switch) is to call the municipal fire department by turning in an alarm from an auxilialized box on the municipal fire alarm system.

The San Francisco and Oakland fire departments each have an auxilialized box connected to the bridge system, and the location on the bridge of the box initiating the signal determines which municipal department will respond.

The system is so constituted that if two signals are turned in at or about the same time, there will be no interference between the two signals, and also, if the power should be off for any reason, any signals initiated during the time the power is off will be transmitted when power is restored to the system.

The power is supplied by a 68-cell storage battery, floated on a copper oxide full wave rectifier.

All signals turned in are received at a supervising unit, located in the garage on Yerba Buena Island, where two tow cars and a fire truck are stationed. This supervising unit makes a printed record of all signals received, giving the nature of call, whether fire alarm, local or general, or tow car service, box, date and time. A punch register located at the Administration Building also records the signals, but does not record the date or time.

The original purpose of the punch register was to let the operator on duty at the switchboard know when an alarm was sent in and also the location.

A tow car is also stationed at the Toll Plaza and provides service for calls from the three easterly box locations and the east approaches.

For Roadside Service, refer to page 93.

Pressure Unit
Planned

It is intended to extend the system and provide three additional boxes on the San Francisco approach, and three boxes on the Distribution Structure. It is also intended to install alarm units in the substations and elsewhere, which will turn in alarms when dangerous temperatures occur at the places where the detecting units are located. A pressure unit is planned to be installed in the pipe which will be placed on the bridge to furnish water to Yerba Buena Island. This unit will turn in a signal when the water pressure falls below a certain value. This is very important since the water line will form a part of the fire fighting system on the bridge.

Control Board
Described

Control and Indicator Board

The Control and Indicator Board is located in the Toll Sergeant's room, just off the main lobby in the Administration Building. Fabricated from "black-on-white" micarta, it is 25 feet long and extends to the ceiling on the west side of the room. Across the lower half of the board is a design, drawn to scale, showing an elevation of almost the entire bridge structure. At the proper points, indicator lights with five-sixteenths inch colored caps are inserted to show the operation of the equipment located there.

Below this elevation is shown the feeder connecting the substations, the indicators and the control switches for each substation breaker, the indicators for each transformer switch, and in the center the group of switches that controls the roadway lighting regulators. Under the proper substations are located the switches and indicators for the two fog signal circuits.

At the top of the board is a plan of the entire project, showing all of the approaches and the connecting roadways on each end. All of the lighting circuits

are indicated on this plan, each pair of indication circuits covering the same area on the plan that the circuits cover on the roadway. The indication circuits are connected alternately so that the operator can tell at a glance the condition of each circuit. This indication of switch and circuit also gives a double check on circuit operation. Conventional colors are used—red for “on” and green for “off” except that the indication on the roadway lights is amber for sodium vapor and white for Mazda luminaires.

The design was sandblasted through the outer black face of the panels into the white layer underneath. It is, therefore, permanent; and so can be cleaned without danger of erasing or defacing.

The practical uses of the board have already justified its installation. Because of its size and location, attention is immediately called to any change in indication on its surface. In addition to its value to the maintenance department, the board offers a graphic method of displaying to the interested visitor the construction of the bridge, a comparison of the component parts and a unique display of the electrical system.

Testing

The electrical testing of roadway lighting circuits and the necessary adjustments were made before these circuits were operated prior to the bridge opening. Although this work was done very hastily and under adverse conditions, subsequent operation has not shown any faults. These tests were carried on cooperatively by contractor's personnel and State engineers.

A different set of tests was made immediately before opening. These consisted of a detailed analysis of luminous intensity at the roadway surface, in selected areas, due to the sodium vapor luminaires. These would have been unobtainable after traffic started because of headlights.

Luminous Intensity
Analyzed

The final testing of distribution system circuits and final accurate setting of under and over voltage protective systems and interlocking devices were postponed until all details of substation installations were completed, and final dressings had been made. Arrangements have been completed for a careful check of these items, using the specialized personnel and equipment of the Pacific Gas and Electric Company. This will be made shortly after June 30, 1937. However, on the few occasions these protective devices have been called upon, they have given satisfactory results.

Status of Work, June 30, 1937

On April 23, 1937, the contractor reported the work completed. A detailed inspection, nevertheless, showed that there were a number of minor items which were either incomplete or unsatisfactory. Correction of these items has been almost entirely completed and it is expected that the work will be ready for final acceptance by August 15, 1937.

Personnel

The work under this contract is being performed by a copartnership of the Alta Electric and Mechanical Company and the American Building and Maintenance Company of San Francisco. Thomas Bennett has been in charge of the work for the contractor. Charles Lane was field superintendent until April 23, 1937, being replaced by C. A. Schwarz. H. M. Tilson is Resident Engineer for the State.

Summary

Contract awarded July 1, 1935. Work started August 1, 1935.

COST	
[Contract No. 11]	
Costs	
Total contract cost.....	\$353,324.00
Total extra work orders	22,091.19
Total expenditures.....	<u>\$375,415.19</u>

COST	
[Contract No. 11A]	
Total contract cost.....	\$89,850.00
Total extra work orders.....	319.23
Total expenditures.....	<u>\$90,169.23</u>

Bridge Traffic Signs

[[Contract No. 12]]

The necessary 121 neon and reflector signs were purchased and installed by the Division of Highways in Sacramento at a total cost of \$4,863.07. This work was supervised by T. H. Dennis, Maintenance Engineer, of the Division of Highways.

Traffic Signs Listed

The signs are as follows:

Neon Signs

- 2 Do Not Enter
- 1 Exit
- 2 Keep Right

These signs were placed at Fifth and First Streets, with wiring and transformers.

Reflector Signs

- 1 First Street Ramp
- 3 Slow
- 5 No Left Turn
- 5 Side Road
- 3 Stop
- 1 Two Way Traffic, Keep Right
- 1 Keep Right
- 4 Private Road for Official Use Only (Yerba Buena Island)
- 1 Trucks
- 6 No 'U' Turns
- 4 City Limit
- 33 No Stopping or Turning on Bridge
- 24 Closed
- 2 Keep To Right
- 1 No Left Turns
- 7 State Speed Limit 45 Miles
- 7 No Parking
- 6 'One Way' Arrows
- 2 Temporary 'Do Not Enter'

Yerba Buena Island Tunnel Lining

[Contract No. 13]

General

The work under this project covered the glazed tile lining of the arched roof and upper deck sidewalls of the Yerba Buena Island Tunnel.

The concrete roof and sidewall surface was sandblasted to provide for a bond between the concrete and the dash coat. This work was completed August 19, 1936.

Gunite Dash Coat

After several experiments, it was found that a gunite dash coat was superior to a hand dash and the guniting was started on August 25, 1936, and completed on September 5, 1936. In order to build up the bedding surface to control points, a scratch coat was next applied by hand, in layers not to exceed one-quarter inch. The average depth of scratch coat was about three-quarter inches. Placing of the scratch coat was started on August 25, 1936, and was completed on October 16, 1936.

The contractor started setting tile on October 28, 1936. A thin coat of mortar was first applied for a setting bed. This was followed by a coat of pure cement paste, after which the tile was placed.

Personnel

The contract for this work was held by the Superior Tile Company, of which John P. O'Shea is vice president.

Harry Carter was Resident Engineer for the State.

Summary

Contract awarded July 15, 1936. Work started July 30, 1936. Date of actual completion, November 10, 1936. Date of acceptance, December 5, 1936.

QUANTITIES

Sandblasting.....	50,540 square feet
Tile lining.....	50,540 square feet

COST

Total contract cost.....	\$55,113.87
Total extra work orders.....	450.00
Total expenditures.....	\$55,563.87

Yerba Buena Island Garage

[[Contract No. 14]]

General

The work under Contract No. 14 consisted of the construction of a one-story concrete building on the Yerba Buena Island right of way, to be used as a garage and firehouse for the bridge tow trucks and fire engine.

The building is a Class B, fireproof, reinforced concrete, rigid frame structure, 31' x 51'; 15' high, and built to provide garage, office, toilet, locker, and shower rooms.

Work was begun with the excavation on September 2, 1936. Concreting was started on September 14, 1936, and all work was completed and the contract cleaned up on December 28, 1936.

Also included in this contract was the construction of a timber guard rail across the opening in the north rail and balustrade of the Yerba Buena Anchorage for the 1939 Golden Gate International Exposition approach road, just west of the tunnel. In addition, under this contract concrete sentry boxes and gate posts were constructed for the United States Navy, in conjunction with the erection of fence and picket gates built under Contract No. 17.

Sentry Boxes Erected

Personnel

The contract for this work was awarded to Alfred H. Vogt. Harry Carter was Resident Engineer for the State.

Summary

Contract awarded August 22, 1936. Work started September 12, 1936. Date of actual completion, December 28, 1936. Date of acceptance, January 21, 1937.

QUANTITIES

(Other than the structure, plumbing, electrical work, and metal lockers)

Excavation.....	380.43 cubic yards
Preparation for subgrading.....	209.23 square yards
Concrete pavement, curbs and gutters.....	39.93 cubic yards

COST

Total contract cost.....	\$14,476.66
Total extra work orders.....	2,774.21
Total expenditures.....	\$17,250.87

San Francisco Section and Approaches

[Contract Nos. 15-15A]

Progress July 1, 1936, to Completion

Status of Work, June 30, 1936

As of June 30, 1936, Contract Nos. 15-15A, covering the Main Approach to Fifth Street in San Francisco and the "On" and "Off" ramps connecting the upper deck of the bridge at the top of Rincon Hill, had reached the point where this work was approximately 70 per cent completed. Up to this date 35 of the 52 main approach spans were entirely finished and eight spans were completed except for railings. The "On" ramp was entirely completed aside from the pavements on the filled approach, and the "Off" ramp had 16 of the 31 spans completed with the exception of railings. (See Volume III.)

During the fiscal year ending June 30, 1937, the sequence of operations already described continued, and the work went forward at a steady rate of progress. All of the structure was completed in time for the opening of the bridge to traffic on November 12, 1936.

Regrade

These contracts also included the regrading and paving of Harrison Street between First and Second Streets, the regrading and paving of Essex Street between Harrison and Folsom Streets, and the grading and paving of the lower deck ramp from Harrison Street to the lower deck of the bridge at the western end of Contract No. 3.

The excavation and preparation of fills were completed during the last fiscal year. During this past year the work covered the paving of the above-described areas. With the exception of the Essex Street section, these pavements were completed by November 12. The Essex Street pavement was completed shortly thereafter.

Paving Completed

Personnel

Personnel on these contracts is the same as given for Contract No. 3.

Summary

Contract awarded January 4, 1935. Work started January 23, 1935. Date of actual completion, January 9, 1937. Date of acceptance, January 21, 1937.

QUANTITIES

[Contract No. 15]

Excavation, unclassified	35,251.00 cubic yards
Excavation, structure	12,736.80 cubic yards



Approach Spans
West Bay Crossing,
November 11, 1936

Concrete viaduct and wall footings	4,183.20 cubic yards
Concrete viaduct and walls above footings	22,440.08 cubic yards
Concrete railing	667.14 cubic yards
Reinforcing steel	4,710,119.00 pounds
Bronze castings	10,609.00 pounds
Cast iron drain pipe and fittings	47,102.50 pounds
Casting	18,324.00 pounds
16" concrete piles	13,766.00 linear feet
18" concrete piles	3,205.00 linear feet
6" vitrified clay pipe	566.40 linear feet
8" vitrified clay pipe	689.70 linear feet
Extra Portland cement	2,822.56 barrels

COST

Total contract cost	\$760,960.33
Total extra work orders	53,862.88
Payment of claim	2,393.42
Total expenditures	*\$817,216.63

Costs

* This sum includes removal of buildings, electrical conduits and fittings.

QUANTITIES [Contract No. 15A]

Excavation, unclassified	225,392.00 cubic yards
Excavation, structure	6,670.37 cubic yards
Concrete viaduct and wall footings	1,294.78 cubic yards

San Francisco
Viaduct,
December 1, 1937



Quantities	Concrete viaduct and wall above footings	6,797.55 cubic yards
	Concrete railings	534.98 cubic yards
	Concrete pavement	2,985.07 cubic yards
	Concrete curbs, gutters	611.93 cubic yards
	Concrete sidewalks	585.75 cubic yards
	Reinforcing steel	2,043,012.00 pounds
	Bronze castings	9,268.00 pounds
	Cast iron drain pipe and fittings	27,969.40 pounds
	Castings	20,427.00 pounds
	18" concrete piles	4,063.00 linear feet
	6" vitrified clay pipe	435.50 linear feet
	8" vitrified clay pipe	297.00 linear feet
	10" vitrified clay pipe	1,202.60 linear feet
	Crusher run base	2,167.83 tons
	Asphalt Concrete	2,677.18 tons
	Extra Portland cement	1,668.07 barrels
	Concrete, "Off" ramp spans	1,732.93 cubic yards

COST

Total contract cost	\$468,229.95
Total extra work orders	18,322.64
Total expenditures	* \$486,552.59

* This sum includes removal of buildings, electrical conduits and fittings, removal and replacement of a 12" x 18" brick sewer; removal and rebuilding 12" x 10" V.C. sewers; removal and replacement 12" C.I. water main.

Operating Equipment

[[Contract No. 16]]

The operating equipment for the San Francisco-Oakland Bay Bridge was purchased through and by the Division of Highways in Sacramento at a total cost of \$102,374.78.

The equipment includes:

Equipment Listed --

- 11 Fire, patrol, paint tower, tow and delivery trucks
- 1 Roadway sweeper
- 1 Painting gantry
- 17 Toll cash registers
- Axle detectors
- 2 Bookkeeping machines
- 2 Coin counting machines
- Shop tools and equipment
- Roadway equipment
- 40 Pistols and belt change makers
- First aid table

Refer also to Maintenance and Operation, page 83.

Island Fences

[[Contract No. 17]]

Requisitions Nos. 1526-1839

In order to control access to the bridge right of way and to the Navy reservation, a fence was constructed enclosing the east and west approach cuts to the Yerba Buena Tunnel. A picket fence and gates were erected at the sentry boxes and gate posts constructed under Contract No. 14 on the two roads which provide access to and from the bridge and Yerba Buena Island Naval Reservation.

Wire Fabric Fence

Erection of the wire fabric fence was started on November 30, 1936, by the Kamlan Fence Company, and completed on January 7, 1937. The fabrication and erection of the picket fence and gates was sublet to the Star Ornamental Iron Works, who started fabrication on February 19, 1937, and completed erection on April 12, 1937. Cleanup was completed on April 12, 1937, and the Naval Authorities accepted the fence and gates on the same date. Total cost of this contract was \$7,063.39.

•7-

Sprinkler System

[[Contract No. 18]]

July 10, 1936, to Completion

General

To fulfill insurance provisions it was required that San Francisco Harbor Piers 24 and 26 and the connecting wharf and shed structure (Pier 24-26) be given adequate fire protection. These are the piers directly under the bridge.

Bids for a fire protection system were advertised on July 10, 1936, and on August 6, 1936, the contract was awarded to the lowest bidder, the Grinnell Company of the Pacific.

The fire protection system may be separated into "wet" and "dry" classifications.

Wet System

The "wet" system is designed for flat surfaces, such as surfaces under roofs, ceilings or the intermediate decks in the sheds. Sprinkler Outlet

In this system water is constantly under pressure up to the sprinkler outlet, which is designed to release the water in fountain form when temperatures arise above 135 degrees Fahrenheit. There are, however, a few sprinklers over the railroad tracks at Pier 24, which are designed to release water at 350 degrees Fahrenheit, the temperature difference being due to the possibility of adverse action from hot engine exhaust gases.

Quartzoid sprinkler outlets for this system are installed under the timber constructed decks at Piers 24 and 24-26, under the roofs of all units and under platform ceilings at Piers 24 and 26.

Control valves from header outlets are placed at the deck level for Pier 24 and at the lower chords of roof trusses for Pier 26. Addressed metal bands seal open the control and main supply valves, and when a valve is closed for any reason the bands must be returned to the Board of Fire Underwriters. The board reseals the valve in the open position. Control Valves

Data pertinent to the wet sprinkler system follows:

	Pier 24	Pier 26	Pier 24-26	Total
No. of groups.....	6	6	2	14
Sprinkler outlets	3,534	2,156	877	6,561
Areas.....	189,000 sq. ft.	132,100 sq. ft.	59,600 sq. ft.	380,700 sq. ft.

Dry System

The outlets of the dry system are installed along the firewalls to cover the outside walls of the sheds and along the upper edges of the roof monitors for roof protection.

These outlets are always open. Heat actuating devices, which operate on a minimum rate of rise of 15 degrees Fahrenheit per minute, are installed at intervals between the sprinklers. The devices operate deluge valves in the control groups, located at deck level for Pier 24 and at the lower chords of roof trusses for Pier 26. Water is released from these sources to the sprinkler outlets from which it emerges in certain form.

The following table gives data pertinent to the dry system.

	Pier 24	Pier 26	Pier 24-26	Total
No. of groups.....	6	8	2	16
Sprinkler outlets.....	365	524	123	1,012
Areas.....	47,000 sq. ft.	71,000 sq. ft.	10,000 sq. ft.	128,000 sq. ft.

Supply Sources

Two 12-inch diameter pipes, connecting at two points with the City of San Francisco main, provides the primary water supply. Water pressure at the point of connection is approximately 60 to 65 pounds per square inch. Headers form the supply sources at the entrance to the piers from the main loop system under the dock at Pier 24 and a loop along the lower chords of roof trusses at Pier 26. Pier 24-26 has only a main header from the cross connection supply running between the two piers.

Construction

Construction work started at Pier 26 on August 31, 1936, and was completed on January 19, 1937. This included a testing period from November 6, 1936, to January 8, 1937.

Special attention was given to the protection of the system from earthquake shocks. All piping was well-braced and flexible couplings were provided between dock and roof truss levels.

Personnel

I. O. Jahlstrom was Resident Engineer for the State, with L. J. Jennings in general charge of the work. Construction work was executed in conjunction with representatives of the Sprinklered Risk Department, Board of Fire Underwriters of the Pacific.

T. J. McWalters had general charge of the work for the Grinnell Company. William Stewart was in charge of field construction.

Summary

Contract No. 18 was awarded August 6, 1936. Work started August 31, 1936. Date of actual completion, January 17, 1937. Date of acceptance, February 1, 1937.

COST

Cost per outlet for the fire protection system, based on the number of sprinkler outlets from both the wet and dry systems, averaged \$17.07 per outlet. Average area per wet system outlet was 58 square feet. Cost for Harbor Piers 24, 26 and the connecting Pier 24-26, respectively, was \$66,530; \$45,750; and \$17,060. Total cost was \$129,340.

Legislative Approaches

Progress July 1, 1936, to Completion

Status of Work, June 30, 1936

Location and financing of the Legislative Approaches to the bridge have been discussed in previous reports (Volumes I, II and III.) As of June 30, 1936, all of the major contracts were completed or under way, with the exception of the Cypress Street line between Thirty-fourth and Seventh Streets, for which bids were taken on June 24, 1936.

Electrical Work on Approaches (Contract No. 84TC2 [11A])

This contract covers the lighting of the San Francisco approaches and the East Bay approach from the bridge to the Distribution Structure. It includes the installation and connection of luminaires on poles and through conduits placed under the Distribution Structure (Contract 64TC26) discussed in connection with Contract Nos. 11 and 11A, covering the lighting of the bridge. (Refer to page 40.)

Sodium Vapor Lights
Installed

Day Labor Work Orders 84T8 and 84W1

Due to the extensive construction work being carried on in the paving of the East Shore Highway from the Distribution Structure northerly, and the difficulty of coordinating the work with the paving contract, it was considered expeditious to install the sodium vapor lights on this section with State forces. These lights were installed on the Legislative Approach to Folger Avenue, and were extended along the East Shore Highway as far as University Avenue in Berkeley. They were a continuation of the system already installed on the main approach, and were connected to the complete lighting system for concurrent illumination through common power, effecting economies in power costs.

This work involved installation of 153 sodium vapor lamps, of which 67 were installed in double units and 19 in single units.

An addition of two 25 k.w. constant current regulators was made in Substation No. 6. Cable was laid, poles erected, and luminaire units installed in 44 calendar days after work started in the field. The circuits were tested less than 48 hours before the bridge was officially opened.

East Bay Approaches

Distribution Structure (Contract 64TC26—84TC1)

At the beginning of the fiscal year, this project was 98 per cent complete. The only work remaining consisted of the final cleanup and a few minor items. All operations were completed on August 11, 1936.

Final Cleanup

*Aerial View of
Distribution Structure,
December 1, 1936*



San Pablo Underpass (Contract 84TC3)

At the beginning of the fiscal year, with this project 84 per cent complete, the only remaining work consisted of the paving of the side roads adjacent to the Underpass. This was completed on August 4, 1936.

Mole Paving (Contract 84TC4)

By June 30, 1936, this project was approximately 55 per cent complete. Rapid progress was continued throughout the early month of the fiscal year, with the major portion of the work completed in time for the opening of the bridge. The final cleanup was deferred until after the opening, so that all efforts could be directed toward consummation of the paving work. The project was recommended for acceptance on November 25, 1936, two weeks after the official bridge opening.

Ashby Avenue Connection (Contract 84TC8)

This project was 35 per cent complete at the end of the fiscal year. The balance of the work was rapidly prosecuted and completed on August 27, 1936.

Cypress Street Improvement (Contract 84TC10)

This project was briefly described in Volume III. At the beginning of the fiscal year actual construction work had not been started. Bids were taken on June 24, 1936, and the contract was awarded to the Hanrahan Company.

Due to the short period of time remaining before the opening of the bridge, this contract was placed on a two-shift basis. All machinery was equipped with lights, and the base course of asphalt concrete pavement was placed by the night shift, with the surfacing course laid during the day. The paving was completed and opened to traffic coincident with the opening of the bridge.

Day and Night Shifts

The replacement of sidewalks and other minor phases of the work was deferred pending the completion of the pavement, and was finished after the opening. All work on the project was completed on December 4, 1936.

F. W. Montell was Resident Engineer.

Landscaping East Bay Fill (Day Labor Work Order 84T2)

The only work done to date on this project has been the propagation of plants. Landscaping and planting will be accomplished during 1938, and will be completed prior to the opening of the Golden Gate International Exposition.

Protection of
Landscaping

San Francisco Approaches

San Francisco Approaches (Contract 64TC24 (15A))

The work under this contract was carried on in conjunction with that of the San Francisco section (Contract No. 15), and full description will be found under that contract. (Refer to page 48.)

San Francisco Plaza Landscaping (Contract 84TC9)

As previously described in Volume III, bids on this work were received on June 3, 1936. The project was completed according to schedule, and all planting was finished on November 7, 1936. The contract provided for a six-months' period of maintenance and development after the planting work was completed. This period ended in May of 1937, and the project was finally accepted on May 24, 1937.

Installation of
Traffic Signs

Traffic Signs (Day Labor Work Order 84T9)

Warning and directional signs on the approaches were placed by State forces. The project was executed in this manner due to the many and varied locations at which the signs were to be placed, which work, if done by contract, would involve considerable difficulty in coordination between contractors and confusion in the maintenance of accounts.

Traffic Stripes (Day Labor Work Order 84T10)

All traffic stripes on approaches were placed by District IV traffic striping crew.

Fencing Special Areas

Immediately prior to the opening of the bridge, the San Francisco Plaza, which had just been planted, was protected by a special installation of fencing, to keep pedestrians from walking on the newly laid lawns. The work was done under Purchase Order for "Fence Installed." After the lawns had been well started, the fence was removed and salvaged for future use. Additional fencing will be placed when the landscaping of the East Bay Fill is completed.

*Proposed Highway to
1939 Golden Gate
International
Exposition*



Highway Patrol Shelters (Day Labor Order 84T11)

This item was not included in previous estimates of work to be done. The shelters were considered necessary for use by the patrolmen in policing the bridge. The amount of \$454 shown in the status of Legislative Approaches represents that cost of work done by State forces. The balance of the work was done under the contracts covering the sections where the shelters were erected, namely, Contract No. 64TC24; Contract No. 15-15A, San Francisco Approaches; and Contract No. 84TC4, Mole Paving.

Other Highway Approaches

*Practicability of
Highway Improvements*

The additional East Bay highway improvements, previously reported under way (Volume III) were completed on schedule, and have adequately demonstrated their practicability of design and construction.

Personnel

The progress of each of the Legislative Approach projects was under the general direction of Col. Jno. H. Skeggs, District Engineer of District IV, Division of Highways, and under the direct supervision of Mr. P. O. Harding, Assistant District Engineer.

STATUS OF RIGHT OF WAY DEEDS ON JULY 1, 1937

LINE	Deeds executed			NET COST		
	Total Num- ber of Deeds	No.	Land	(Not including rental credits nor cost of title reports, insurance, engineering, legal expense, contingencies, etc.)		
				Improvements, etc.	Total	
Bridge	Original line	60	58	\$758,313.95	\$531,624.05	\$1,289,938.00
	Stillman Street change	47	45	397,537.00	339,810.91	737,347.91
	Totals	107	103	\$1,155,850.95	\$871,434.96	\$2,027,285.91
San Francisco Bridge approaches	5th Street Approach	11	11	\$222,193.75	\$174,890.14	\$397,083.89
	"On" Ramp	8	7	98,607.50	26,315.00	124,922.50
	"Off" Ramp	34	31	175,310.80	319,501.76	494,812.56
	Account of grade	18	10	45,733.00	47,225.53	92,958.53
	Totals	71	59	\$541,845.05	\$567,932.43	\$1,109,777.48
Alameda County Bridge approaches	Cypress Street	89	88	\$188,509.20	\$152,407.11	\$340,916.31
	38th Street	60	58	217,875.16	184,843.91	402,719.07
	Albion Avenue	43	36	90,904.13	26,739.21	117,643.34
	Totals	222	212	\$497,288.49	\$363,990.23	\$861,278.72
	Grand totals	400	374	\$2,194,984.49	\$1,803,357.62	\$3,998,342.11

CONTRACT PAYMENTS AS OF JUNE 30, 1937

No.	Vehicular Contract	E.W.O.	Total	To Complete	Total of Contracts
2	\$7,398,623	\$76,136	\$7,474,759	.....	\$7,474,759
3	1,057,105	27,143	1,084,248	.....	1,084,248
4	4,473,815	104,275	4,578,090	.....	4,578,090
5	1,390,664	33,330	1,423,994	.....	1,423,994
6	13,990,499	383,330	14,373,759	\$201,000	14,574,759
7	9,057,520	161,783	9,219,303	.....	9,219,303
8	255,770	7,401	263,171	.....	263,171
9	854,233	33,214	887,447	.....	887,447
10	345,800	7,256	353,056	.....	353,056
11	353,668	18,263	371,931	.....	371,931
12	14,477	450	15,554	.....	15,554
13	14,477	450	15,554	.....	15,554
14	14,477	450	15,554	.....	15,554
15	763,354	53,862	817,216	.....	817,216
16	94,996	94,996	189,992	.....	189,992
17	150,340	150,340	300,680	.....	300,680
18	150,340	150,340	300,680	.....	300,680
19-17	12,014	.....	12,014	97,719	109,733
Totals.....	\$40,836,827	\$1,237,152	\$42,073,979	\$326,908	\$42,400,887

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS—DIVISION OF HIGHWAYS
STATUS OF WORK ON LEGISLATIVE APPROACHES TO SAN FRANCISCO-OAKLAND BAY BRIDGE

Contract No.	Description	Estimated Cost (Including contingencies)	Estimated Total Work Done to July 1, 1937	Per- centage Complete	Contractor
64TC6	Dredger fill	\$961,770.45	\$961,770.45	100	American Dredging Company
64TC8	Rock wall	279,488.61	279,488.61	100	Fredrickson & Watson and Fredrickson Bros.
64TC16	Pacso Subway	96,336.10	96,336.10	100	Healy-Thibbitts Construction Co.
64TC16A	San Francisco approaches	555,000.00	539,248.05	100	Healy-Thibbitts Construction Co.
64TC66-84TC1	Distribution structure	1,185,000.00	1,180,568.85	100	Barratt & Hilp
64TC69	Folger Avenue Underpass	131,800.63	131,800.63	100	J. F. Knapp
84TC2 (11A)	Lighting approaches	92,000.00	90,169.22	100	Alta Electric & Mechanical Co., Inc., and American Building Maintenance Co.
84TC3	San Pablo Underpass	375,000.00	374,443.99	100	J. C. Knapp
84TC4	Marina Underpass	271,376.07	279,904.13	100	Hinchman Wilcox Corp.
84TC8	Ashby Avenue connection	31,400.00	31,392.90	100	L. C. Seidel
84TC9	Landscaping 5th Street Plaza	16,000.00	16,210.71	100	California Nursery Co.
84TC10	Cypress Street, 34th to 7th	140,000.00	135,916.97	100	Hinchman Co.
84T8	Lighting (from Distribution Structure to Folger Avenue)	31,700.00	21,433.18	100	Work done by State forces
84T10	Traffic signs	18,825.00	18,574.56	100	Work done by State forces
84T11	Landscaping special areas	18,500.00	18,574.56	100	Work done by State forces
Purchase Order	Landscaping East Bay fill	5,000.00	799.39	14.6	Work to be done by State forces
84T2	Highway Patrol shelters	50,000.00	3,689.09	7.4	Work done by State forces
84T11	Subtotal Engineering	\$4,171,696.86	\$4,094,666.43	98	*Includes preliminary investigations, preliminary design, construction laboratory and R.O.W. engineering complete.
	Subtotal Property	\$4,573,696.86	\$4,480,913.77	98	
	Totals	\$6,793,696.86	\$8,575,580.20	95	
	Totals		\$6,586,969.21	97	

† Includes \$480,152 property used jointly by highway approaches and Bridge Interurban Railway.

FOURTH ANNUAL
PROGRESS REPORT

. . . PART II . . .

BRIDGE RAILWAY

Bridge Railway

Status of Work, June 30, 1936

Progress on the Bridge Railway during the year has consisted of the acquisition of property required for the railway facilities, the demolition of the buildings thereon and the preparation of the necessary contract drawings and specifications to carry out the work.

General

Throughout the design of these facilities many problems requiring more than the usual investigation have arisen.

The basic problem is that of handling an annual traffic of 35,000,000 passengers with 17,000 passengers traveling in one direction in a 20-minute peak. Only one track in each direction across the bridge is available for this peak traffic, which makes it necessary to schedule ten-car trains on a 63-second headway. Since this condition results in a greater density of traffic than has hitherto been experienced, safe operation is possible only by employing the most modern developments in the science of railway signaling.

The design is further complicated by the fact that two voltages are required: 1350 volts for the Southern Pacific and 625 volts for the Key System.

The construction of these railway facilities is being divided into separate contracts, the division being made on the basis of class of work and, to some extent, on the basis of the location of the work.

At the east end of the bridge it is necessary to provide a storage yard for the railway equipment, which is not in use on off peak periods. Connections to the existing lines of the Key System and Interurban Electric will be made here.

For this purpose, the Mole Fill of the Key System is being enlarged by reclamation to a total of 42 acres. This will provide storage for 123 Interurban Electric cars, 90 Key articulated units, and 15 Sacramento Northern cars.

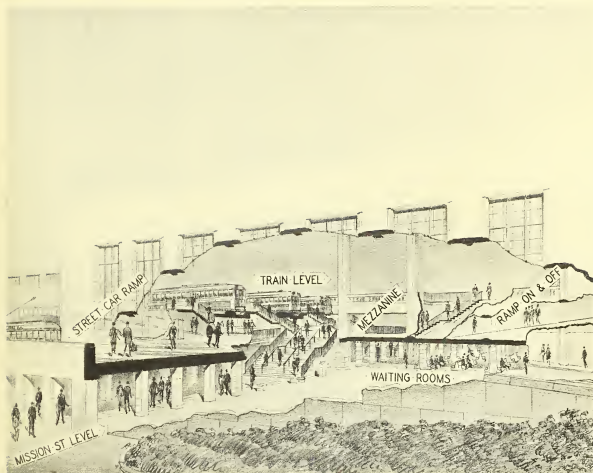
The construction of the highway approaches and the railway yard severed the Outer Harbor Area of the Port of Oakland from the North Harbor. Furthermore, the existing system of highway approaches did not adequately serve the Outer Harbor Area and West Oakland. There is therefore being provided, in connection with the railway program, an additional highway approach, designated as the Port of Oakland Overhead, which will span the highway and the storage yards. The grading in the yard, as well as the rearrangement of certain tracks, signals, and other facilities, is being done by the Key System.

Demolition for San Francisco Terminal

[[Contract No. R-1]]

This contract for the demolition and removal of buildings on the site of the San Francisco Terminal was awarded on December 1, 1936, to the Cleveland Wrecking Company at a price of \$121,175.

Work has proceeded since that date and the contract will be completed on August 1, 1937.



*Cutaway Drawing
Showing Interior of
San Francisco
Terminal Building*

San Francisco Terminal

[Contract No. R-2]

This contract covers the construction of the San Francisco Terminal, located between Mission, Natoma, Beale and Second Streets.

The structure is to be of the loop type. Six tracks with four platforms are being provided. This arrangement will afford ample time for unloading and loading passengers; will give some leeway in making up time for off schedule trains; and will eliminate congestion on the platforms.

San Francisco surface cars will make a loop in front of the station, over a ramp elevated to the mezzanine level. Three tracks, with a capacity of four cars each, are to serve this purpose. Provision is being made to connect with the proposed municipal subway at Fremont Street.

Type of Structure

The Terminal Building will be a reinforced concrete, flat slab structure. Roof and street crossings will be steel rigid frames. The design calls for the Mission Street facade to be faced with granite.

Track Facilities

For the purpose of reducing noise and vibration, the track ties are to be embedded in concrete, which will be insulated from the remainder of the construction. Provision has been made for concessions and public garage space in the structure.

For purposes of construction, the work has been divided into four contracts. Bids were received on June 16, 1937. Low bidders were:

Contractors Named	MacDonald & Kahn, Inc.	General construction	\$1,658,510
	Columbia Steel Company	Structural steel work	442,360
	Scott Company	Mechanical work	109,257
	Radelfinger Bros.	Electrical work	73,250
TOTAL			\$2,283,377

Contracts will be awarded to the low bidders. (Refer to Appendix E, page 22-A.)



Upper:
Artist's Drawing and
Aerial View Showing
Bridge Railway
Viaduct and Terminal
Building,
San Francisco

Lower:
Artist's Drawing East
Bay Bridge Railway
Approaches

San Francisco Viaduct

[[Contract No. R-3]]

Trains will ply over this viaduct between the Terminal and the bridge.

The design of the structure calls mainly for reinforced concrete construction, similar to that used for the vehicular approaches. Bids on this contract will be received in August.

Reinforced
Concrete Design

Substructure—East Bay Yards

[Contract No. R-4]

Description of Work

This contract includes the construction of the foundations for the catenary bridges; the Port of Oakland Overhead; the Southern Pacific Yard Overhead, which separates the grades of the Key System and Southern Pacific main line tracks; and the Southern Pacific Twenty-sixth Street Overhead, which will carry the Inter-urban Electric tracks across the main line of the Southern Pacific. The contract for the work was awarded on March 1, 1937, to the Bates & Rogers Construction Corporation. Work started shortly thereafter and was six per cent completed by June 30.

Catenary Footings

Pile Driving Excavation for the catenary footings was started May 12, 1937, followed by footing forms, pile driving, reinforcing steel and concreting operations. To date, this portion of the work is approximately five per cent completed. The equipment used consisted of a half-yard crane mounted on a truck chassis and equipped with track layer attachments. Piles are being driven with a skid derrick equipped with swinging leads. Concrete is being hauled to the job in transit mix trucks from Berkeley.

Port of Oakland Overhead

Equipment Excavations started on the Port of Oakland structure April 5, 1937, followed by the pile driving and concrete operations. A two-yard clamshell bucket was used for excavating and a 90-foot skid derrick with a 5000-pound single acting hammer was used for driving the piles. Concrete is being furnished by a local transit mix company and hauled to the job in four-yard mixer trucks. The concrete is dumped into bottom dump concrete buckets and from there placed directly in the forms by means of a 60-foot crawler crane. To date, this portion of the work is approximately five per cent completed.

Personnel

The officers of Bates and Rogers Construction Corporation are: Walter A. Rogers, president; Frederick L. Copeland, vice president. R. Rasmussen, district manager (in direct charge of the work). Harry Carter is Resident Engineer for the State of California.

Railroad Signals and Interlocking Work

[[Contract No. R-5]]

General

The contract includes the installation of the complete system of signals with the exception that the cab signals are included with the equipment. The contract was awarded on December 11, 1936, to the General Railway Signal Company at a price of \$1,368,402.

All train operations across the bridge will be controlled by cab signals whereby the indications as to the conditions on the track are brought into the motorman's cab. This system provides for the four speeds of 35, 25, 17, and 11 miles per hour, a light in the cab indicating when these speeds have been reached.

Cab Signal Control

The signals actuating the apparatus are transmitted by coded track circuits, the codes being picked up by a receiver mounted on the front axle of the train.

When the permissible speeds are exceeded by one mile per hour, a warning bell rings in the cab and when the excess speed reaches two miles per hour, an automatic emergency brake application is made.

All tracks in the San Francisco terminal area and all main and setout tracks in the storage yard are interlocked. For this purpose, an "N-X" system of interlocking is being installed, in which system no operating levers are required, the routes being set up by the manipulation of control knobs on a control board.

*Drafting Room,
Bridge Railway
Construction Office*



Superstructure—East Bay Yard

[[Contract No. R-7]]

General

*Description of
Contract*

The work to be done consists in general of the construction of the superstructure of the Twenty-sixth Street Crossing of the Interurban Electric tracks in the City of Oakland; the superstructure for the Interurban Electric Overhead Crossing in the yard; the bridges for the electric distribution and feeder system; and the approach fills of the Interurban Electric Overhead Crossing and the Twenty-sixth Street Crossing.

The contract was awarded to J. H. Pomeroy Company on April 6, 1937, for the sum of \$536,960 and was approved on the 23d of April, 1937. To date, no work has been started.

Buildings—East Bay Yard

[[Contract No. R-8]]

Service Buildings

Contract R-8 will cover the construction of the service buildings in the East Bay yard. This contract will be advertised in the summer of 1938.

Materials

[Contracts Nos. R-9, R-10, R-11, R-21A, R-21B, R-21C]

Materials for track, catenary construction, and track bonding Contracts Nos. R-9 and R-10, are furnished by the State. The accompanying table shows all materials received to date, June 30, 1937, together with their value.

Materials Received to Date

June 30, 1937

<i>Quantity and Item</i>	<i>Cost</i>	
44,000 anti creepers	\$10,375.48	
5,463 pairs angle bars	16,755.89	Materials Listed
1,850 abrasion plates	1,042.79	
925 insulated joints	12,229.03	
590,000 pounds track spikes	17,384.00	
262,800 feet trolley wire	40,348.28	
191,994 feet feeder cable	25,023.56	
26,914 copper rail bonds	22,636.99	
9,000 brass welding rods	3,724.69	
1,735 gross tons 90-lb. rails	75,388.80	
11,000 redwood ties	11,519.20	
	\$236,428.71	

Materials ordered so far have a total value of \$844,000; weight, 23,000 tons; and require 124,000 square feet, or 2.85 acres, of storage space.

Construction of the East Bay Yard Fill necessitates rebuilding and maintaining 3,000 feet of existing track under traffic. This traffic consists of 100 cars daily, each loaded with 60 tons of fill material. The track was removed and replaced "piece-meal" causing a minimum of delay in traffic. To date 1,800 feet of temporary track have been laid.

Contact wire and feeder cable are shipped by rail on reels of 2,500 to 5,500 pounds each. They are unloaded by an electric crane and stored in the open on planks and covered with roofing paper.

Welding rods, rail bonds, and insulated joints were shipped by rail, unloaded by hand, and stored in a warehouse at 3435 Wood Street, Oakland.

New rails came by boat to the Oakland Outer Harbor, thence by rail to the point of delivery. They were unloaded by truck crane, stored on timber grillage built to a level surface. Load on the foundations is kept under one ton per square foot.

All other materials, except ties, are being shipped by rail, and unloaded by hand and stored on platforms of two-inch planks laid on sand. They are then oiled, roofed over or covered with building paper to protect them from the weather.

Ties are hauled by truck direct from the woods to point of delivery. They are stacked in piles of 200 each to allow air seasoning and facilitate accounting.

So far, 30,000 cut ties have been stacked at the mill at Fort Bragg for air seasoning. They are to be delivered as required.

East Bay Storage Yard

[[Contracts Nos. R-21, R-21A, R-21B, R-21C]]

General

The work under these contracts covers the construction of the East Bay Storage Yard and involves the widening of the present Key Fill between the east bridgehead and the Oakland shore.

The Yards will also be used for the storage of equipment in off-peak periods. Inspection buildings under Contract R-8 are also to be located in this area.

The Key Route is now operating its trains over this section on the way to the Key Pier and all work in this area has to be done under conditions which will not interfere with such operation.

The work also involves the shifting of the main Key System tracks, as well as those of the freight subsidiary of the Key System, the Oakland Terminal Railroad.

Reclamation
In order that this project may proceed without interference with the Key operations, it was decided that several parts of the work could be done to the best advantage by Key System forces. This portion of the work involves the reclaiming of the area, having a total length of about 8,000 feet and an average width of 300 feet. Material for this fill will total 309,072 tons.

Contracts R-21A, covering the placing of track and ballast in the yard; R-21B, the bonding; and R-21C, the catenary and feeders, will be let under contracts, in our usual manner.

Fill

Unloading Operations
Fill material is being shipped by gondola cars to the Oakland Terminal tracks, located on the present Key Mole, at the rate of approximately 100 cars per day. Unloading and placing operations are being carried on twenty-four hours a day. The equipment being used for this purpose consists of two 2-yard clamshells; two 75 h.p. caterpillar bulldozers; and two lighting plants.

Riprap is to be hauled in by 400-ton barges and placed with floating equipment. This work will start the first week in July. Actual construction of the fill started on May 1, 1937, and to date 215,000 tons, approximately 75 per cent, of the material have been placed.

Southern Pacific Connections

[[Contract No. R-22]]

The connections to the existing East Bay Interurban line of the Southern Pacific require a viaduct which will carry bridge train tracks over the main line tracks of the Southern Pacific at Twenty-sixth Street, Oakland. The substructure of this bridge will be constructed under Contract R-4, and the superstructure under Contract R-7.

To get adequate clearance for the piers supporting this bridge, considerable realignment of the Southern Pacific main line tracks was involved. The connection also will involve certain rearrangements of the company's existing electric railway tracks and catenary.

S. P. Main Line
Tracks Realigned

Included under this contract also will be the tying in of the signals, protecting these new facilities, to the existing Southern Pacific Tower at Sixteenth Street. These operations will be done by the Southern Pacific Company.

Telephone System

Contract R-6 will include a complete telephone system tying in all parts of the Bridge Railway. The cables in this system will also include the control wires for the substations.

Substations

Power for the operation of the Bridge Railway will be supplied at 12,000 volts a.c. by the Pacific Gas and Electric Company, who will also build the substations for the account of the two railroads. Three substations will be required, one to be located at Sterling and Harrison Street in San Francisco, one at the east end of the Storage Yard, and one on Yerba Buena Island. Conversion to 1,350 volts will be made at the two end substations only; the Island substation will furnish only 625 volts.

Three Substations
Required

Equipment

In preparing for operations over the Bridge Railway, an extensive program of alterations to, and rebuilding of, the rolling stock is required. All interurban electric equipment will have cab signals and automatic couplers. The motorization of 12 trailers is also required. The Key System's equipment is being entirely rebuilt so that at the start of bridge operations that company will have 88 streamlined articulated units. Cab signals are also being installed on 17 Sacramento Northern cars.

Key System
Equipment Rebuilt

INTERURBAN JUNE 30, 1937

CONTRACT PAYMENTS

No.	Contract	E.W.O.	Total	To Complete	T C
.....	\$67,615	.....	\$67,615	\$53,560	
.....	30,606	.....	30,606	687,757	
.....	2,319,928	.....	2,319,928	150,072	
s.....	\$2,418,149	.....	\$2,418,149	\$891,389	

ESTIMATED COST OF CONTRACTS TO BE LET

No.		
.....	San Francisco Terminal General Construction.....	\$1
.....	San Francisco Terminal Structural Steelwork.....	
.....	San Francisco Terminal Mechanical.....	
.....	San Francisco Terminal Electrical.....	
.....	San Francisco Terminal Store Fronts, Etc.....	
.....	San Francisco Viaduct.....	
.....	Signals and Interlocking.....	1
.....	Telephone System.....	
.....	Superstructure East Bay Yard.....	
.....	Buildings, East Bay Yard.....	
.....	Trackwork and Contact Rail.....	1
.....	Catenary and Feeders.....	
.....	Track Bonding.....	
.....	Painting Cables.....	
.....	East Bay Yard—Trackwork.....	
.....	East Bay Yard—Bonding.....	
.....	East Bay Yard—Catenary and Feeders.....	
.....	East Bay Yard—Key System.....	
.....	Southern Pacific Connections.....	
.....	Southern Pacific—Santa Fe Interchange Yard.....	
.....	Interurban Railway Equipment.....	1
.....	Sacramento-Northern Railway Equipment.....	
.....	Off Line Connections.....	
	Totals.....	\$10

SAN FRANCISCO-OAKLAND BAY BRIDGE
CONSOLIDATED STATEMENT OF RECEIPTS AND EXPENDITURES
FROM SEPTEMBER 14, 1932, TO JUNE 30, 1937

RECEIPTS		
Bonds sold to R.F.C.		
From June 12, 1933, to May 6, 1936		\$46,000,000.00
July 2, 1936	\$3,000,000.00	
August 5, 1936	3,000,000.00	
October 6, 1936	3,000,000.00	
February 25, 1937	3,000,000.00	
April 20, 1937	3,000,000.00	
Total		\$15,000,000.00
Transfer from State		\$61,000,000.00
Interest from Banks		10,803.39
Accrued interest		59,132.78
Rents from property acquired		19,395.83
		16,246.36
		\$61,105,578.36
CONSTRUCTION EXPENDITURES		
Veicular bridge	\$55,055,614.54	
Interurban	5,510,033.06	
		\$60,565,647.60
Balance with State Treasurer		\$539,930.76
EXPENDITURES—VEHICULAR BRIDGE		
Engineering design	\$414,527.57	
Triangulation and survey	\$52,576.09	
Launch operation	124,210.00	
Administration	526,752.90	
		\$1,318,066.56
Consulting engineers and architects		514,968.98
Insurance		562,887.74
Legal		132,409.97
Property		2,147,453.10
Rental Pier 24		90,591.25
Moving cables		95,170.47
Inspection		329,682.21
Contracts to contractors—		
2. Substructure West Bay		7,474,759.14
3. San Francisco Anchorage		1,084,247.80
4. Substructure East Bay		4,580,189.88
5. Yerba Buena Island Crossing		9,239,208.04
6. Superstructure West Bay		14,372,759.11
7. Superstructure East Bay		9,219,302.02
8. Girder spans and mole		263,170.95
9. Final field painting		887,446.86
10. Administration Building		353,056.27
11. Electrical work		326,008.94
12. Traffic signs		4,950.59
13. Tunnel lining		55,563.87
14. Island garage		16,553.52
15. San Francisco section		817,216.63
16. Operating equipment		94,995.48
17. Island fencing		7,063.69
18. Fireproofing outside hazards		155,387.16
Field engineering and expense, all contracts		1,004,407.00
Interest and discount		6,795,097.31
Total Vehicular Bridge		\$55,055,614.54
INTERURBAN		
Engineering design and administration	\$351,272.44	
Legal expense	6,591.59	
Property	2,529,965.49	
Interest and discount	153,378.17	
Insurance	16,000.00	
Contracts		
R-1. Demolition		72,690.58
R-2. Terminal Building		3,952.27
R-4. Substructure East Bay yard		46,725.96
R-5. Signals and interlocking		320.88
R-7. Superstructure East Bay yard		569.44
R-9. Track work and contact rail		1,354.81
R-10. Overhead and feeders		237.94
R-21. East Bay yard		5,999.84
R-22. S.P. crossing		1,032.63
R-23. Southern Pacific-Santa Fe Interchange Yard		12.42
R-31. Key equipment changes		2,319,928.60
Total interurban		\$5,510,033.06



FOURTH ANNUAL
PROGRESS REPORT

. . . PART III . . .
OPERATION AND MAINTENANCE

Bridge Opening

The last few weeks prior to the official opening of the bridge to vehicular traffic saw a general and rapid cleanup of construction activity.

Ten contracts had not yet been brought to actual completion, including Contract No. 5, Yerba Buena Island Tunnel and Anchorage; Contract No. 6, West Bay Superstructure; Contract No. 9, Painting; Contract No. 10, Administration Building and Toll Plaza; Contracts Nos. 11-11A, Electrical Work; Contract No. 14, Island Garage; Contracts Nos. 15 and 15-A, San Francisco Anchorage and Approaches; and Contract No. 18, Sprinkler System.

However, the remaining work to be done in no way interfered with opening day ceremonies or with the movement of traffic which has continued without interruption since the signal "Go" was flashed from the desk of the President of the United States at Washington, D. C., at 12:30 o'clock noon, November 12, 1936.

Final Bridge
Inspection

Chief Engineer C. H. Purcell made a final inspection trip of the bridge on November 10, 1936, accompanied by Bridge Engineer Charles E. Andrew, Engineer of Design Glenn B. Woodruff and members of the Board of Consulting Engineers. With the exception of Mr. Daniel E. Moran, whose ill health prevented his presence, the entire board attended, including Mr. Ralph Modjeski, chairman; Mr. Leon S. Moisseiff, Mr. C. S. Proctor, Mr. Charles Derleth, Jr., and Mr. H. J. Brunnier.

At the conclusion of the inspection trip the board passed the following resolution unanimously:

Resolution Consulting
Engineers

"WHEREAS, The San Francisco-Oakland Bay Bridge has been carried to a successful completion and has been inspected by the Board of Consulting Engineers; and

"WHEREAS, This Board of Consulting Engineers approve in all respects the design and construction of all parts of this project; therefore be it

"*Resolved*, The Board expresses its appreciation of the great services which Charles H. Purcell, Chief Engineer, has rendered to the bridge project by his leadership in organizing, planning, and building the bridge. By his untiring efforts, good judgment and tact the organization of the engineering staff was effected, the plans were promptly developed and the erection of the structure was rapidly pushed to completion.

"The Board expresses its appreciation of the good services of Charles E. Andrew, Bridge Engineer, and Glenn B. Woodruff, Engineer of Design, in designing and building the bridge. By their untiring effort and constant watchfulness they and their staff have made the numerous computations and designs, details and procedures in the office and the field which have made possible the continuous and successful construction of the bridge."

Long before dawn on Thursday, November 12, motorists had lined up to be among the first to cross the bridge. By actual opening hour streets and highways leading to east and west approaches were jammed with vehicles.



*Final Bridge
Inspection Trip,
November 10, 1936.
Left to right:
Charles Derleth, Jr.,
Glenn B. Woodruff,
Leon S. Moittetiff,
H. J. Braunier,
C. H. Purcell,
Carlton S. Proctor,
Ralph Modjeski,
Chas. E. Andrew*

It had been decided to break barriers on both ends of the bridge to symbolize the clearing of the highway. Heavy gilded chains were placed across a lane at the Toll Plaza on the east end of the bridge and at the foot of the Fifth Street approach on the west. In addition, a chain was stretched across the bridge at Tower W-5. This was done for the benefit of newsreel cameramen and photographers who wished a bridge background not so effectively allowed at the east and west ends due to the great length of the structure.

A grandstand was erected by the Oakland Junior Chamber of Commerce in the square east of the Administration Building where ceremonies began at 10 o'clock, participated in by several thousands of persons.

Mr. Harrison S. Robinson, president of the Financial Advisory Committee, presided, and federal and state officials and those of adjacent counties and municipalities were honored guests. Among the speakers were Governor Frank F. Merriam, Director of Public Works Earl Lee Kelly, Chief Engineer C. H. Purcell; The Honorable Charles B. Henderson, Director Reconstruction Finance Corporation; former President Herbert Hoover; former Governor C. C. Young; Dr. William J. McCracken, Mayor of Oakland; Mayor E. N. Ament of Berkeley; Mr. William J. Hamilton, chairman Alameda County Board of Supervisors; Mr. W. J. Buchanan, chairman Contra Costa County Board of Supervisors.

With the conclusion of ceremonies on the east side at 12 o'clock noon, Governor Merriam, flanked by Director of Public Works Earl Lee Kelly and Chief Engineer

*Oakland Opening
Ceremonies*

*Governor Merriam
Cuts Chain*

*Chain Cutting
Ceremonies
Toll Plaza,
November 12, 1916.
Left to right:
Director of Public
Works Earl Lee Kelly,
Governor Frank F.
Merriam,
Chief Engineer
C. H. Purcell*



*San Francisco
Ceremonies*

C. H. Purcell, cut the chain barrier at the toll gate with an acetylene torch. The Governor and his official party then hastened to their cars and proceeded across the bridge toward San Francisco, stopping at Tower W-5 to cut the second chain in similar manner. The party then continued on its way across the bridge.

At the Fifth Street Plaza a third and last chain was cut clearing the way for traffic on the west end, when the proper signal should be given, and members of the party, leaving their cars, proceeded across the Plaza to the grandstand erected by the City of San Francisco.

Mr. Leland W. Cutler, vice president of the Financial Advisory Committee, presided at the San Francisco ceremonies. Governor Merriam, Director Kelly and Chief Engineer Purcell spoke briefly again. Other speakers were United States Senator William Gibbs McAdoo, Lieutenant Governor George J. Hatfield and Mayor Angelo J. Rossi of San Francisco. Workmen on the bridge were represented by Mr. Walter Gaines, construction foreman.

*President Roosevelt
Opens Bridge*

At 12:30 o'clock noon signals, designed to represent traffic lights, flashed green when President Franklin D. Roosevelt, sitting in the White House at Washington, pressed a golden telegraph key. Whistles from the hundreds of craft, large and small, and factory whistles of the entire San Francisco Bay area added to the thunderous din created by a gun salute of the United States fleet at anchor in the harbor.



*Scene at the Toll
Plaza After
Opening Signal,
November 12, 1936*

Immediately traffic began to move across the bridge, starting simultaneously from both ends of the structure.

The San Francisco-Oakland Bay Bridge was open.

The City of Oakland which had started its celebration on Armistice Day, November 11, continued its fiesta. The opening of the bridge signalized the start of the San Francisco celebration which lasted four days, the first day of which was staged under the direction of the San Francisco Junior Chamber of Commerce.

Events included day and night parades in which cities of California and neighboring states participated. Streets were gaily decorated and store windows carried appropriate and colorful displays. Opening ceremonies and a detailed account of the official trip across the bridge were broadcast over Coast-to-Coast hook-ups by the National and Columbia broadcasting companies.

The United States Government coined a fifty-cent piece commemorating the event and cachets were issued by the Post Office. The San Francisco celebration committee was subsequently able to refund in part donations to fiesta subscribers so successful was the undertaking.

Celebration Success

In the first three and one-half days of its opening the bridge carried a total of 228,913 vehicles without accidents other than mishaps no more consequential than bent fenders.



*Traffic Starts Over
the West Bay Crossing,
November 12, 1936*



*Traffic Starts Over
the East Bay Crossing,
November 12, 1936*

Governor Merriam said in his San Francisco dedication address:

Governor Merriam
Speaks

"We have assembled upon this occasion to celebrate the completion of this great Bridge. In so doing, we are following a custom that has marked the progress of highway construction throughout the Nation. The building of bridges has always stimulated the interest and aroused the enthusiasm of our people. But never had any group a greater incentive for celebration than have we because we are dedicating a bridge of stupendous construction, magnificent design, marvelous beauty, amazing strength and, withal, a capacity for unlimited service."

Director Kelly said:

"The opening of this Bridge is the first step in eliminating the isolation of San Francisco, an isolation which will never be entirely done away with until the Bridge is toll free. This Bridge today becomes a part of our state highway system, a highway system that is equalled by none in the world. It will do much to help the great Exposition San Francisco is planning in 1939 and it will bring the cities of the Bay district into closer union."

Six Million
Dollars Saved

Mr. Purcell said:

"This Bridge stands today ready for motor transport with a saving of over six million dollars under the estimated authorization for its construction. It is available for the use of the public six months in advance of the scheduled completion date with a saving in cost of interest on bonds during construction of over a million and a half dollars."

R. F. C. Director
Henderson

R. F. C. Director Charles Henderson declared:

"Great and magnificent as this structure is, it will not convey to the men, women and children crossing on its decks the unseen obstacles encountered in its building.

"Those whose engineering skill and science have created this Bridge and the men far above the waters who have done the work deserve the highest praise. It is not only a monument to the genius of Charles H. Purcell, the engineer in charge, it is a symbol of the unlimited capacity of modern men, working together through government to unify the physical world around them."

5-

Operation and Maintenance

November 12, 1936, to June 30, 1937

General

The San Francisco-Oakland Bay Bridge is a unit in the highway system of the State of California. It is operated and maintained as a district of the Division of Highways, Department of Public Works. Charles E. Andrew is principal bridge engineer in charge of operation and maintenance. The California Toll Bridge Authority is the governing fiscal body.

All bridge employees are under State civil service.

Traffic and Income

The vehicular facilities for the San Francisco-Oakland Bay Bridge were opened to traffic at 12:30 p.m. on November 12, 1936, with ceremonies elsewhere described. On the following Sunday, November 15, a record of 75,218 vehicles crossed the bridge.

During the seven and one-half months of operation a total of 5,837,894 vehicles crossed the bridge, an average of 25,272 per day.

A detailed traffic report and record of income are given in Tables Nos. 1 and 2 on pages 98 and 99, respectively.

When the bridge opened, a toll schedule was fixed by the Toll Bridge Authority, which was approximately 20 per cent below that which had been charged by the ferries operating between San Francisco and the East Bay. On February 1, 1937, the bridge tolls were reduced so that they are now approximately 37 per cent below the former ferry charge. These toll schedules are shown in Table No. 3, page 99.

The ferries met each of the reductions as they were made.

Twenty Percent
Transbay Toll
Reduction

Financial Statement

By law and by agreement with the Reconstruction Finance Corporation, the bridge revenues are devoted to debt service, the payment of premiums on use and occupancy insurance, and certain other small items such as bondholders' audits and inspections. At the end of the fiscal year, the outstanding debt was as follows:

Bonds		Interest	Bonded Indebtedness
Series	"A"	5%	
	"B"	4 $\frac{3}{4}$ %	
	"C"	4 $\frac{3}{4}$ %	
	"D"	4 $\frac{3}{4}$ %	
	"E"	4 $\frac{3}{4}$ %	
	"F"	4 $\frac{3}{4}$ %	
Total			\$61,260,000



Toll Collectors

With reference to the Series "A" Bonds itemized above, there is an additional \$100,000 of these bonds outstanding, which are to be redeemed by the City and County of San Francisco.

In addition to the bonded debt, the State of California advanced approximately \$6,600,000 from the gasoline tax fund for construction of the bridge approaches. This money must be repaid after all bonds have been retired.

All bonds, except Series "A," are held by the Reconstruction Finance Corporation. By an executive order of the President of the United States, three-quarters of one per cent of the interest paid on these bonds is being refunded. This order is effective until April 1, 1939.

The financial statement of the revenue fund is given in Table No. 4, page 100.

Maintenance Expenses

All maintenance and operation expenses are paid from funds accruing to the State from the State gasoline tax. A complete statement of these expenditures is shown in Table No. 5, page 100.

Toll Collection

Tolls are collected from all vehicles crossing the bridge with the exception of state-owned vehicles used for operation or maintenance of the bridge, privately owned vehicles of contractors doing work on the bridge, and private or United States Government-owned vehicles going to or from Yerba Buena Island.

*Toll Collectors
Peace Officers*

Every vehicle passing through the toll gates must surrender to the collector a commutation ticket, a pass ticket, cash, or sign a charge slip. Collections are made by uniformed and armed toll collectors who are peace officers with the power to arrest.

When the bridge was opened, toll collectors worked eight-hour shifts in the lanes with nearly an additional hour required to check in and out. It was found that these hours were excessive and, in consequence, a four-shift day was inaugurated for week days, while on Saturdays, Sundays, and holidays, the shifts are eight hours. This schedule approximates a 44-hour week. The average week-day shift is as follows:

Four Shift Day

		Collectors
1:00 a.m.— 7:00 a.m.	.....	4
7:00 a.m.— 1:00 p.m.	.....	9
1:00 p.m.— 7:00 p.m.	.....	10
7:00 p.m.— 1:00 a.m.	.....	6

For Sundays an average shift is as follows:

		Collectors
7:00 a.m.— 3:00 p.m.	.....	12
3:00 p.m.—11:00 p.m.	.....	14
11:00 p.m.— 7:00 a.m.	.....	6

Typical hourly traffic flows are shown in Figures 1 and 2, pages 86 and 87.

Equipment

Sixteen toll lanes are provided for the passage of vehicles. The two outside lanes in each direction are equipped with scales for handling trucks. Two scales have a capacity of 40 tons with 60-foot platforms, and the remaining two have a capacity of 30 tons with 40-foot platforms. The scales are of the dial type equipped with a tare beam and were installed by the manufacturer. Truck drivers are required to show a certificate of weight of the unloaded truck. This amount is set on the tare beam and the truck load is then read from the dial. The truck is charged a flat rate while the load is charged on the basis of weight.

The registers in the four freight lanes also were installed by the manufacturer. These registers print a ticket showing the date, transaction number, collector number, register number, and the toll for the vehicle, the freight carried and any extra passengers. If the transaction is to be charged, a triplicate charge slip is made by hand and signed by the driver. The register prints and thus certifies all of this data on the original of these slips and the latter is retained on file. One copy is handed to the driver at the time of passage, while the third copy is forwarded with the invoice at the end of the month.

Registers

The registers in the freight lanes are capable of handling any type of vehicle permitted to cross the bridge.

Registers accumulate the total number of each type of transaction and money collected. At the end of each shift the toll sergeant takes a printed record of the totals from the registers and directs it to the accounting department. The collectors do not see the totals.

The twelve passenger lanes are equipped with special toll registers which accumulate the number of each type of transaction. At the end of each shift, or more frequently if desired, the totals are printed on a tape locked within and inaccessible to the collector. Tapes are removed daily by the accounting department.

Axles are automatically counted by roadway treadles and the count totaled on the register tapes.

Axle Counters

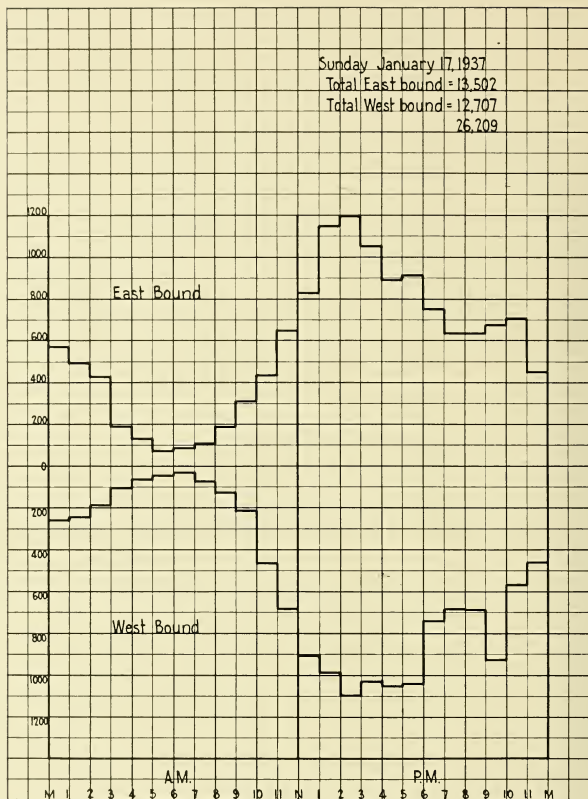


Figure 1

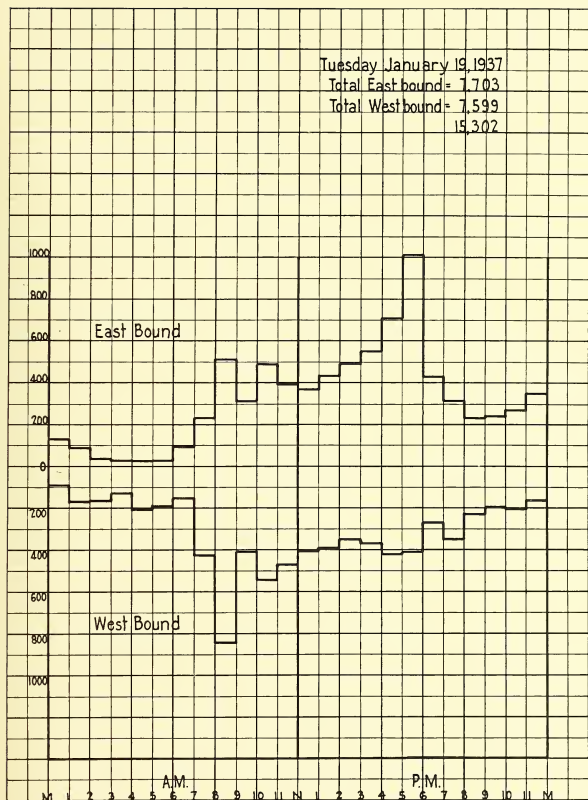


Figure 2

When going on duty, each collector is supplied with a money box which is conveniently fastened by clips to the top of or set on a shelf beside the register. These boxes are fitted with sliding covers and carrying handles, and can be removed very quickly. At the end of each shift, the collector takes box and contents to a counting room. He counts and places all tickets and money, except his \$200 change fund, in a sealed canvas bag. This bag is then dropped through an outside depository into a vault connecting with the cashier's room. The change funds are kept in safety boxes in the toll sergeant's room and are under a double lock requiring the presence of the sergeant as well as the collector to remove them.

The deposited collections are counted by the bridge tellers and deposited with the banks daily. The tellers' counts are compared with the collectors' counts and the register records in the accounting department. After the initial rush of opening traffic, very excellent percentages of accuracy have been attained by the collectors. Accuracy records are posted every two weeks and keen competition to head the list has developed among the collectors.

Overages and shortages are added in arriving at a collector's errors. For the month of June, 1937, the average error on this basis for the entire crew was \$0.431 per \$1,000 collected. The net error for the same month was \$0.0215 over per \$1,000 collected.

Electrical Maintenance

The electrical maintenance force is responsible for maintaining and operating the following systems:

1. 18.36 miles roadway lighting on bridge and approaching highways illuminated by 1,081 sodium vapor and 106 mazda lamps.
2. Illumination and pumping systems in the San Pablo Avenue and Folger Avenue underpasses.
3. Aerial and water navigation beacons, channel markers, and obstruction lights.
4. Fog sirens and bells.
5. Police telephones and call lights.
6. Maintenance telephones.
7. Fire alarm and tow service call system of 32 combination duplex boxes.
8. Illuminated traffic signs on the bridge and approaching highways.
9. Administration Building and toll lane lighting, heating, and power.
10. Vehicle and tariff counting, classifying, and registration equipment.
11. Intercommunicating telephones and public address system.
12. A direct current control and indication system, including the largest known control and indication board.

GENERAL

The electrical force is divided into three eight-hour shifts with one journeyman electrician on duty during each of the night shifts, and the balance of the force on the day shift. The day shift handles all routine inspection, repairs, servicing, cleaning and adjustments of equipment and devices; all general construction work, and



*Interior Views of
Administration
Building.
Lower left shows
Control Board in
Toll Sergeant's Room*

*Electrical
Maintenance Crew
and Equipment*



all lamp changing except illuminated traffic signs or emergency navigation lights, which are handled by the night shift.

The night shift provides a stand-by service for emergencies. The duties include the adjustment of relays returned to the shop by the day forces, testing of lamps, making necessary repairs around the toll lanes, and attending to any general shop work which may develop. The night shift also operates the telephone switchboard from 11:00 p.m. to 7:00 a.m. of the following day.

During Sundays and holidays the force provides 24-hour service on the telephone switchboard. Once each evening a patrol is made of both decks of the bridge and approaches to observe the condition of all lights and a report is filed for use of the day shift. Any emergency changes required are made by the patrol.

Check-chart System

A check-chart system is used on all routine inspections. A special report form is provided for each major device on which is printed the name of each part which is vital to the proper functioning of the device, with space provided to indicate the condition of the part and any work done to it. This system insures inspection of all parts and eliminates oversights.

SODIUM VAPOR LAMPS

Lamps Guaranteed

A visible card record of sodium vapor lamp replacements is maintained, from which the life of these lamps can be accurately determined. As the lamps carry a guarantee, the manufacturer credits the State for those found to be defective on

the basis of the ratio of hours burned to the guaranteed burning hours. This record has enabled the State to claim a credit of \$1,144.71 for unreceived burning hours on sodium vapor lamps removed from service. Table No. 6, page 101, shows sodium vapor lamp replacements to the end of the 1936-1937 fiscal year.

All lamp changes on the roadway lighting system are made by the handy man and equipment operator. It has been found that this crew, with the use of the tower truck, can service from 12 to 16 lighting standards in one eight-hour shift.

NEW CONSTRUCTION

Many additions and improvements have been made to the electrical system on the bridge as the need for them has developed under operating conditions. This work has been handled by the maintenance force and has included such items as the installation of capacitors totaling 400 k.w. to improve the system's power factor; complete installation of a 10-station interoffice telephone in the Administration Building; relocation of all sidewalk indicators; installation of six additional telephones on the existing police and maintenance lines and installation of new bases and relocation of transformers on 16 light standards at the Fifth Street Plaza.

Interoffice Telephone

In addition, the electrical crew of the Bay Bridge and its equipment have assisted Highway District IV when there was need. The 16 sodium vapor luminaires and wiring for the Waldo Tunnel on the Golden Gate Bridge approach in Marin County, and the lighting systems on signs at Hayward, El Cerrito, and Seventh and Cypress Streets in Oakland were handled in this manner.

EQUIPMENT

Electrical equipment includes:

A one and one-half ton tower truck. The tower has a vertical extension of 11 feet and in its extended position the platform is 23 feet above roadway level. The platform rotates through 360 degrees and can be extended to six and one-half feet beyond the side of the tower.

A one-half ton panel delivery general utility car. Its equipment includes a one and one-half k.w.-120 V-DC generator, a 16-inch searchlight, and racks for ladders and conduit.

Maintenance of Structure

As might be anticipated for a recently completed structure, the necessity for extensive maintenance has not yet appeared and hence activities of the seven and one-half months since the bridge opening have been of a minor nature.

PAINTING

Painting requirements on some 14,000,000 square feet of steel bridge surface will ultimately require the continuous services of approximately 50 men, but as yet this crew has not been organized. It is probable that the nucleus of a paint crew will be active shortly.

Painting Force and Equipment

Equipment such as paint brushes, spray equipment, scaffolding, and tackle, necessary to start a paint crew in operation, has been purchased and is on hand. At the present time there is under contract the construction of a gantry scaffold for painting between decks. This equipment will ride the lower deck roadway curb and



*Upper left:
Maintenance Shop*



*Upper right:
Switchboards*



*Lower left:
Two-way Loud
Speaking System
Connected with
Toll Lanes*



*Lower right:
Money-counting
Machine,
Cashier's Office*

provide an unobstructed passageway for vehicles. Access to the upper-deck deck steel over the interurban tracks and above the catenary lines will be made by means of a swinging cantilever arm on the gantry. Delivery of this piece of equipment is expected shortly.

EQUIPMENT

- 1 one and one-half ton special body truck.*
- 5 pressure paint tanks, 15 gallon capacity.
- 8 spray guns.

*Truck constructed to transport painters and equipped with compressor and spray paint tank.

STRUCTURAL REPAIR

No structural repair has been required on the bridge since opening, and none of major nature may be anticipated, under normal conditions, for several years. In view of this fact it is not considered necessary to have a steel maintenance crew on the bridge at the present time. Minor repairs are handled by general maintenance labor.



*Upper left:
Sweeper*

*Upper right:
Bay Bridge Fire Truck*

*Lower left:
Paint Truck*

*Lower right:
Dump Truck*

GENERAL MAINTENANCE

General maintenance on the bridge, immediate approaches and parking areas, is under the supervision of a maintenance foreman. In addition to his maintenance duties this foreman has charge of a fire truck and an emergency tow and roadside service. On June 8, 1937, maintenance of the Plaza at the Fifth Street entrance to the bridge in San Francisco was assumed by the bridge. A full-time gardener has been assigned to duties at the plaza under the general maintenance foreman.

Duties of the roadway maintenance force include slope and embankment repair, minor fills at points of settlement on approaches, correction of drainage obstructions, weekly cleaning of bridge and adjacent areas within the bridge right of way, and repairs of minor nature caused by careless drivers, and roadway surface patching.

Once a week the bridge roadway is given a complete brooming with a motor sweeper. This equipment is rented one day a week by the Golden Gate Bridge District for similar service on the Golden Gate Bridge.

In addition to its normal duties, the fire truck is used as required to wash out drains on the bridge, wash the Yerba Buena Tunnel interior surface, and once a month to check the accuracy of the weigh scales in the truck lanes at the Toll House.

In collaboration with the Materials and Research Laboratory of the Division of Highways a trial has been made of a rubber latex and SC-4 road oil compound developed by the laboratory as an expansion joint and crack filler. These tests have been satisfactory and sufficient material has been ordered to fill all roadway joints on the structure. Maintenance forces will do this work.

*Duties of Maintenance
Crew*

Fire Truck Duties



*Roadside Service
Crew and Equipment*

*Reflector Buttons
Installed*

As a measure of protection to vehicle traffic 867 reflector buttons were placed on the center line of the upper deck roadway between the Administration Building on the Oakland side and the Fifth Street Plaza in San Francisco. Reflectors were placed 40-foot centers on tangent and 20-foot centers on curves. E. J. Treacy, San Francisco, installed the reflectors at a contract cost of \$2,005.25.

ROADSIDE SERVICE

*Twenty-four Hour
Roadside Service*

A 24-hour emergency roadside and fire truck service is maintained on the bridge. Tow and roadside emergency service is handled by three tow trucks: one on a five-ton chassis and two on a one and one-half-ton chassis. The fire truck, completely equipped with chemical extinguishers and a 300-gallon water tank, is stationed on Yerba Buena Island within ready reach of any part of the bridge.

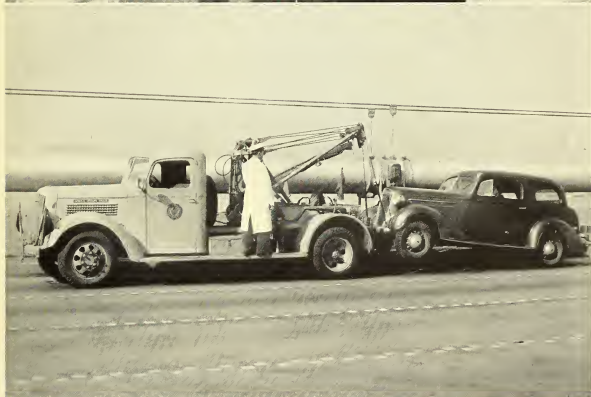
The average number of vehicles serviced for the seven and one-half months of operation has been 21.5 daily, or one service for every 1,178 vehicles crossing the bridge. Calls for the fire truck, included in the above figure, have totaled 17 to date, or an average of slightly greater than two per month.

For a detailed summary of the roadside service, see Table No. 7, page 101.

EQUIPMENT

Equipment Listed

- 1 motor driven sweeper
- 2 one-ton dump trucks
- 1 light pick-up truck (maintenance foreman)



Upper left:
Fire Alarm and
Tow Car Call Box
Installed on Bridge

Upper right:
Recording Machine
in Yerba Buena
Island Garage

Lower:
Bridge Tow Car
Aids a Motorist

- 1 tudor car (maintenance engineer)
- 1 tow truck on five-ton chassis
- 2 tow trucks, on one and one-half ton chassis
- 1 fire truck with water capacity 300 gallons. Soda and acid and foamite chemical extinguishers
- 1 105 cubic foot engine-driven compressor
- 1 asphalt kettle with kerosene burner

MAINTENANCE SHOP

A small but complete shop is housed in the Administration Building. The shop furnishes adequate maintenance and repair service for all bridge automotive equipment and toll collection registers, and performs general maintenance work in the Administration Building and toll lanes. It also handles the makeup of any special tools or equipment that are needed. An example is the development of a new fog bell striker mechanism.

EQUIPMENT

Shop Equipment

- 1 60-ton hydraulic press
- 1 12" floor grinder
- 1 blower forge
- 1 gas welding outfit
- 1 brake lining machine
- 1 cable hoist
- 1 20" shaper
- 1 16" lathe, direct motor driven
- 1 21" vertical drill press
- 1 bench drill
- 1 valve refacer
- 1 power hack saw
- 1 battery rectifier
- 1 broom winding rack
- 1 bench drill (electric shop)
- 1 bench grinder (electric shop)

Resignation of Financial Advisory Committee

On March 9, 1937, the Citizens Financial Advisory Committee for the San Francisco-Oakland Bay Bridge tendered its resignation in a letter to Governor Frank F. Merriam.

At a meeting of the California Toll Bridge Authority in Sacramento on March 20, the Governor put the motion of acceptance before the body, stating that he did so as an expression of appreciation for the invaluable work achieved by the committee. Members of the Authority voted to accept the resignation on motion of Mr. Earl Lee Kelly, Director of Public Works, seconded by Mr. A. E. Stockburger, Director of Finance.

Resignation Accepted

The letter of resignation read:

March 9, 1937.

The Honorable Frank F. Merriam
Governor of California
Sacramento, California

DEAR GOVERNOR:

The Financial Advisory Committee of the San Francisco-Oakland Bay Bridge was appointed by the late Governor James Rolph, Jr., in February, 1932. During his administration and subsequently at your request under your administration, we have, either as a body, through a subcommittee or through our officers, rendered active service in connection with many phases of the financing, construction and operation of the San Francisco-Oakland Bay Bridge.

Active Service by
Committee

During this period of five years some of our members have died and some have retired because of the pressure of other affairs.

We who remain feel that the tasks which the Committee was created to undertake have now been performed to the best of our ability. We therefore tender to you as President of the California Toll Bridge Authority the Committee's resignation.

To you, to Director of Public Works Earl Lee Kelly, to the other members of and to all the staff of the Authority, we express deep appreciation for consistent assistance, support and cooperation, often given under difficult circumstances. We know that seldom has a great public enterprise been carried to fruition with such ability and skill or with such unselfish and single devotion to a fine performance of the job to be done.

The Bridge stands, an enduring memorial to the living and to the dead who gave their best to its creation.

Respectfully

HARRISON S. ROBINSON
President

GEORGE T. CAMERON
Chairman, Executive Committee

J. R. KNOWLAND
E. B. DE GOLIA
JOHN P. SYMES
E. CLARENCE HOLMES

RAY H. GLASSLEY
J. H. QUINN
FRANK C. MACDONALD
WM. W. CROCKER

TABLE No. 1

TRAFFIC RECORD

Month	Total Vehicles	Passenger Autos	Auto Trailers	Motorcycles	Tricars	Trucks	Truck Trailers	Buses	Bus Passengers and Extra Passengers	Freight, lbs.	Commuter Books Sold	Commuter's Usage
November, 1936	664,584	648,131	460	2,241	204	9,490	694	3,364	130,503	16,732,714	194	74.5%
December, 1936	670,644	643,440	813	2,000	405	18,098	1,283	4,405	113,497	32,336,571	455	95.6%
January, 1937	575,072	550,106	542	1,615	402	16,792	1,455	4,230	93,092	33,879,000	554	94.9%
February, 1937	667,562	640,253	502	1,860	513	18,783	1,809	3,842	105,276	40,788,833	1,062	91.9%
March, 1937	766,315	731,424	799	1,959	599	24,604	2,341	4,659	125,210	52,808,500	1,523	95.9%
April, 1937	766,764	730,808	1,045	2,508	581	24,466	2,594	4,582	124,171	52,808,500	1,523	95.9%
May, 1937	830,867	785,225	1,086	3,361	676	28,026	2,344	9,109	193,118	56,532,333	1,496	93.2%
June, 1937	830,867	785,225	1,086	3,361	676	28,026	2,344	9,109	193,118	56,532,333	1,496	93.2%
Total since opening	5,838,179	5,584,116	7,501	18,878	4,000	165,640	14,947	42,753	1,080,214	353,002,117	7,665	94.9%

TABLE No. 2
INCOME RECORD

Month	Total Vehicles	Total Collections	Average Vehicles per Day	Average Toll per Vehicle
November, 1936	664,584	\$442,131.90	34,979	\$0.6653
December, 1936	670,644	447,032.15	21,634	.6667
January, 1937	575,072	382,570.96	18,551	.6653
February, 1937	667,562	347,598.10	23,842	.5267
March, 1937	766,315	400,267.40	24,720	.5223
April, 1937	766,764	400,564.10	25,559	.5224
May, 1937	896,371	469,343.25	28,904	.5238
June, 1937	830,867	439,622.90	27,695	.5291
Totals for 231 days	5,838,179	\$3,329,130.76	25,272	.5703

TABLE No. 3
TOLL SCHEDULE

Class	Vehicle	Rate	
		Nov. 12, 1936, to Jan. 31, 1937, inclusive	Feb. 1, 1937, and subsequent
1	Automobiles, ambulances, taxis, commercial or light delivery automobiles, all with driver and not to exceed four (4) additional passengers	\$0.65	\$0.50
	Passengers in excess of four (4).....	.05	.05
2	Commute—Passenger automobiles only with driver and not to exceed four (4) passengers, fifty (50) one-way trips in any calendar month.....	22.50	17.50
	Passengers in excess of four (4)..... each	.05	.05
3	Trailers drawn by automobiles	.50	.50
	Passengers riding trailer..... each	.05	.05
4	Trucks (with driver).....	.75	.75
	Passengers in excess of driver..... each	.05	.05
5	Truck trailer.....	.75	.75
	Passengers riding trailer..... each	.05	.05
6	Buses with driver.....	.75	.75
	Passengers in excess of driver..... each	.05	.05
7	Motorcycle with driver.....	.20	.20
	Additional passengers..... each	.05	.05
8	Tricar with driver.....	.30	.30
	Additional passengers..... each	.05	.05
9	Vehicles not otherwise specified and requiring a special permit to travel on bridge..... per 100 pounds	.03 1-2	.03
10	Load carried on any truck or truck trailer..... per 100 pounds	.03 1-2	.03

TABLE No. 4
STATEMENT OF TOLL REVENUE FUND AS OF JUNE 30, 1937

Toll revenue	\$3,329,130.76
Interest on deposits	3,002.40
Suspense account	4,696.21
Use and occupancy insurance, Sept. 1, 1936-Sept. 1, 1941 ..	\$3,336,829.37
	128,000.00
	\$3,208,829.37
State Treasurer	\$3,128,586.45
Cashier	53,909.22
Counterfeit coins	97.75
Accounts receivable	30,453.45
	\$3,213,046.87
Less July commutes in cashier's fund	4,217.50
	\$3,208,829.37

TABLE No. 5
STATEMENT OF EXPENDITURES FOR MAINTENANCE AND
OPERATION PERIOD FROM NOVEMBER 12, 1936, TO JUNE 30, 1937

Pay roll	\$110,941.74
Office supplies and telephone and telegraph	3,945.05
Heat, light, and water, Administration Building	938.44
Maintenance supplies	12,761.25
Electricity	15,588.00
Legal and printing	3,130.58
Advertising	419.77
Miscellaneous charges	617.36
Insurance—	
Property damage, Sept. 1, 1936, to Sept. 1, 1941	537,612.36
Compensation insurance reserve and retirement reserve	3,548.60
Employee's bonds	560.42
Burglary insurance	134.40
Total expenditures	\$690,197.97

TABLE No. 6

SODIUM VAPOR LAMP OPERATION, NOVEMBER 9, 1936, TO JUNE 30, 1937

Total number of luminaries—bridge and approaches	1,081
Total number of burned-out lamps replaced	557
Total number of original lamps still in operation	584
Average burning hours for system	2,484
Average burning hours per lamp of burn-outs plus originals still in service	1,973
Per cent lamps replaced to total luminaries	52
Per cent original lamps still in operation	54

SEGREGATION—LAMP REPLACEMENTS

	Total Luminaries	Replaces- ments	Per Cent Replaces- ment
San Francisco approaches	106	47	44%
Suspension bridges	244	148	61%
Tunnel	31	16	52%
East portal of tunnel to E-28	226	108	48%
East Bay approaches, Distribution Structure and East Shore Highway	472	238	51%

TABLE No. 7

ROADSIDE SERVICE SAN FRANCISCO-OAKLAND BAY BRIDGE NOVEMBER 12, 1936—JUNE 30, 1937

Vehicles supplied with gasoline	2,765
Vehicles towed (engine trouble, no spare tires, accidents, etc.)	1,511
Tires changed	664
Fires	17
Total vehicles serviced	4,957
Average number of vehicles serviced per day	21.5
Number of vehicles crossing bridge per vehicle serviced	1,178

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PICTORIAL PROGRESS
OF
SAN FRANCISCO-OAKLAND
BAY BRIDGE

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CONTRACT 3—S. F. ANCHORAGE AND VIADUCT



ENTRANCE—S. F. ANCHORAGE
NOV. 27, 1936



S. F. ANCHORAGE—Dec. 8, 1936



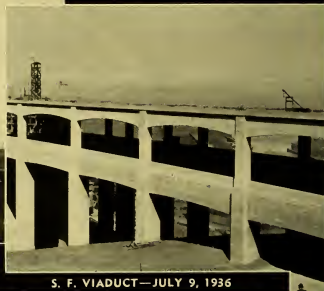
S. F. ANCHORAGE
SEPT. 24, 1936



NO. WALL—S. F. ANCHORAGE—AUG. 26, 1936



PIER W1—NOV. 17, 1936



S. F. VIADUCT—JULY 9, 1936



S. F. VIADUCT—AUG. 17, 1936



S. F. VIADUCT—JAN. 21, 1937

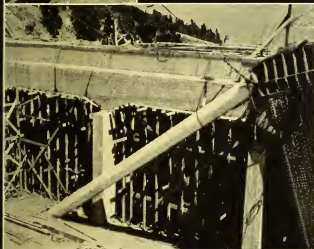
CONTRACT 5—YERBA BUENA ANCHORAGE AND TUNNEL



TUNNEL—WEST PORTAL—JULY 28, 1936



Y. B. ANCHORAGE—JULY 1, 1936



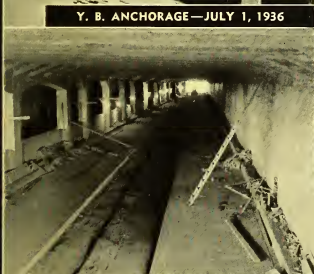
Y. B. ANCHORAGE—JULY 1, 1936



WEST PORTAL—SEPT. 10, 1936



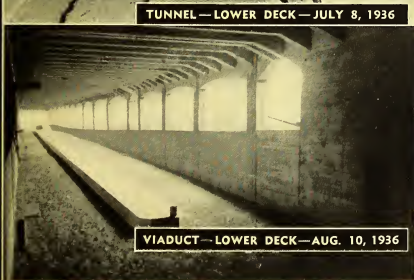
Y. B. VIADUCT—AUG. 24, 1936



TUNNEL—LOWER DECK—JULY 8, 1936



TUNNEL—LOWER DECK—AUG. 10, 1936



VIADUCT—LOWER DECK—AUG. 10, 1936



Y. B. ANCHORAGE—AUG. 10, 1936

CONTRACT 6—WEST BAY SUPERSTRUCTURE CABLES



SUSPENDER CABLES—SPAN W1-W2
AUG. 14, 1936



HAND WRAPPING—SPAN W6-W7
SEPT. 2, 1936



SOUTH CABLE—TOWER W6
NOV. 19, 1936



NO. & SO. CABLES—SPAN W2-W3—AUG. 7, 1936



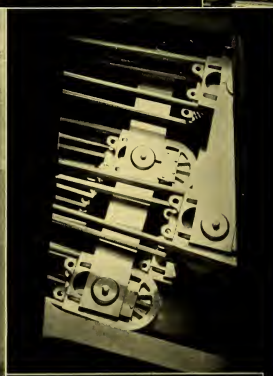
NORTH CABLE—Y. B. ANCHORAGE—SEPT. 29, 1936



SOUTH CABLE—CENTER ANCHORAGE
NOV. 6, 1936



N. & S. CABLES—S. F. ANCHORAGE
NOV. 23, 1936



SOUTH CABLE—S. F. ANCHORAGE
NOV. 27, 1936

CONTRACT 6—CABLES (Continued)



SO. CABLE—Y. B. ANCHORAGE—JULY 8, 1936



NO. & SO. CABLES—SPAN W1-W2
AUG. 7, 1936



SO. CABLE—SPAN W1-W2—JULY 13, 1936

CONTRACT 6—TOWERS



HOOD—TOWER W6—SEPT. 2, 1936



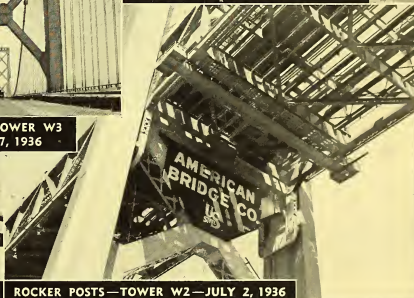
HOOD—TOWER W3
AUG. 7, 1936



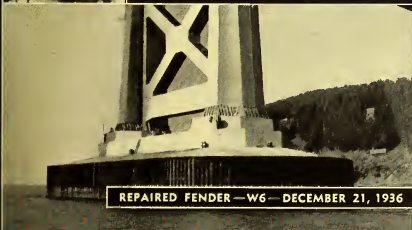
HOOD—TOWER W2—AUG. 7, 1936



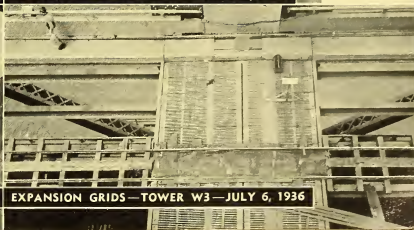
HOOD—TOWER W5—AUG. 17, 1936



ROCKER POSTS—TOWER W2—JULY 2, 1936



REPAIRED FENDER—W6—DECEMBER 21, 1936



EXPANSION GRIDS—TOWER W3—JULY 6, 1936

CONTRACT 6—CENTER ANCHORAGE



NORTH HOOD — W4 — JULY 6, 1936



CENTER ANCHORAGE
DEC. 21, 1936



NORTH HOOD — W4 — JULY 3, 1936

CONTRACT 6—SUSPENSION SPANS



STIFFENING TRUSS — JULY 13, 1936



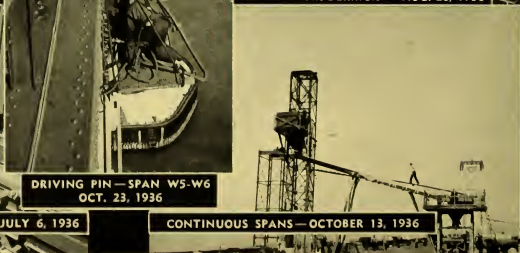
DRIVING PIN — SPAN W5-W6
OCT. 23, 1936



GINNY-WINK DERRICK — AUG. 28, 1936



UPPER DECK — SPAN W2-W3 — JULY 6, 1936

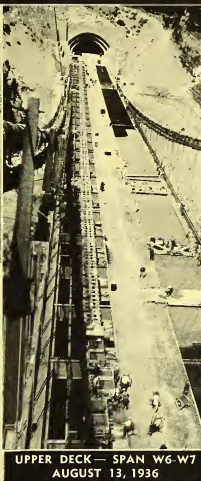


CONTINUOUS SPANS — OCTOBER 13, 1936

CONTRACT 6—SUSPENSION SPANS (Continued)



SPAN W2-W3—JULY 13, 1936



UPPER DECK—SPAN W6-W7
AUGUST 13, 1936



SPAN W1-W2—JULY 6, 1936



SPAN W2-W3—JULY 6, 1936



SPAN W2-W3—JULY 13, 1936



SPAN W1-W2—OCT. 5, 1936



SPAN W5-W6—JULY 28, 1936



N. & S. CABLES—SPAN W4-W5—OCT. 23, 1936

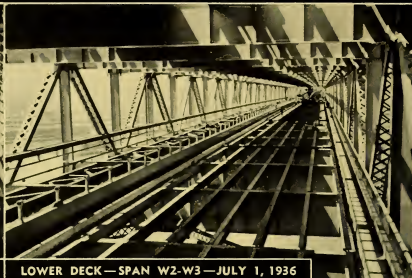


UPPER DECK—SPAN W1-W2—OCT. 5, 1936

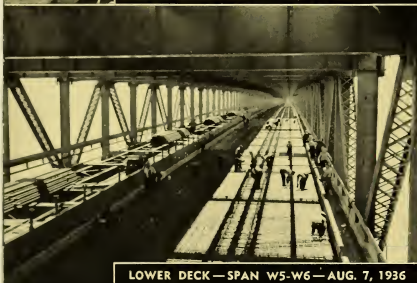
CONTRACT 6—SUSPENSION SPANS



LOWER DECK—SPAN W5-W6—AUG. 21, 1936



LOWER DECK—SPAN W2-W3—JULY 1, 1936



LOWER DECK—SPAN W5-W6—AUG. 7, 1936



LOWER DECK—SPAN W1-W2—OCT. 5, 1936

CONTRACT 7 SUPER-STRUCTURE EAST BAY CROSSING



RAILROAD EXPANSION JOINT—E-11
JULY 28, 1936



Y. B. SPANS—JULY 1, 1936



TOP DECK EXPANSION JOINT—E-11
JULY 28, 1936

CONTRACT 10—ADMINISTRATION BLDG. AND
TOLL PLAZA



TOLL PLAZA—SEPT. 23, 1936



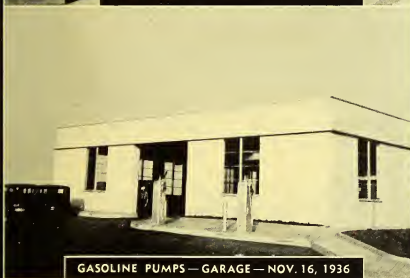
TOLL PLAZA—SEPT. 10, 1936



TOLL BOOTH—PLAZA—SEPT. 7, 1936



TOLL PLAZA — OCTOBER 20, 1936



GASOLINE PUMPS—GARAGE—NOV. 16, 1936



TOLL BOOTH AND SCALE—NOV. 2, 1936



TOLL PLAZA—JUNE 15, 1936



TOLL PLAZA—AUG. 18, 1936

CONTRACT 9—PAINTING



SO. CABLE—SPAN W2-W3—SEPT. 2, 1936



WEST ANCHOR ARM—OCT. 6, 1936



CANTILEVER SPAN—OCT. 22, 1936



PAINTING SIDEWALK—OCT. 22, 1936



EAST CANTILEVER ARM—OCTOBER 22, 1936



PAINTING CURB—SPAN W5-W6—NOV. 4, 1936

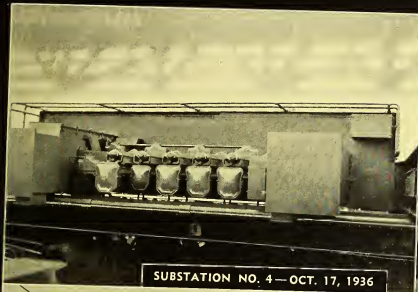


SO. CABLE—S. F. ANCHORAGE—NOV. 27, 1936



SO. CABLE—S. F. ANCHORAGE—NOV. 27, 1936

CONTRACT 11—ELECTRICAL WORK



SUBSTATION NO. 4—OCT. 17, 1936



SUBSTATION NO. 5—SEPT. 17, 1936



LUMINAIRE—SPAN W6-W7
OCTOBER 23, 1936



SWITCHBOARD—SUBSTATION No. 5
SEPTEMBER 17, 1936



DOUBLE LUMINAIRE—MOLE FILL
SEPTEMBER 17, 1936



ROTATING BEACON—TOWER E-2—SEPT. 15, 1936



SUBSTATION NO. 3—EAST END—SEPT. 17, 1936

CONTRACT 11—ELECTRICAL WORK (Continued)



LUMINAIRE UNIT—"B" LINE
AUGUST 27, 1936



ROTATING BEACON—TOWER E-2
SEPT. 15, 1936



FOG BELL—PIER W4
OCT. 15, 1937



LUMINAIRE UNITS—"B" LINE—AUG. 27, 1936



LIGHT STANDARDS—AUGUST 27, 1936

CONTRACT 13—TUNNEL LINING

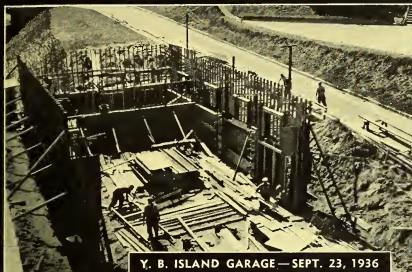


TUNNEL—SANDBLASTING ROOF—AUG. 10, 1936



TUNNEL—TILING ROOF—OCTOBER 2, 1936

CONTRACT 14—ISLAND GARAGE



Y. B. ISLAND GARAGE—SEPT. 23, 1936



Y. B. ISLAND GARAGE—OCT. 19, 1936

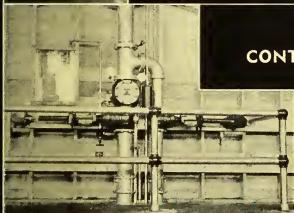


Y. B. ISLAND GARAGE—NOV. 18, 1936

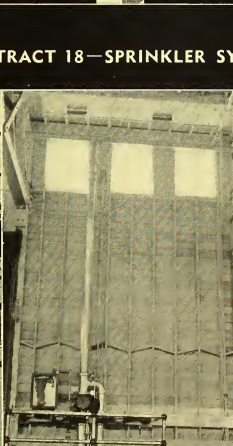


Y. B. ISLAND GARAGE — FEB. 17, 1937

CONTRACT 18—SPRINKLER SYSTEM



SPRINKLERS—BULKHEAD
PIERS 24-26—JAN. 20, 1937



SPRINKLER SYSTEM—PIER 24—JAN. 24, 1937



SPRINKLERS
ROOF PIER 24—JAN. 19, 1937



CONTRACT 15--S. F. APPROACH



"OFF RAMP"—SPANS #208-#223—JULY 9, 1936



TRUCK OFF RAMP—JULY 7, 1936



APPROACH—SPANS #50-#51—OCT. 26, 1936



SAN FRANCISCO APPROACH—AUGUST 5, 1936



SAN FRANCISCO APPROACH—OCT. 13, 1936



"ON RAMP"—JANUARY 21, 1937



PATROL SHELTER—"OFF RAMP"—NOV. 10, 1936



ESSEX STREET ROADWAY—NOV. 25, 1936

CONTRACT 15—S. F. APPROACH (Continued)



"OFF RAMP"—SPANS #201-#209—SEPT. 30, 1936



"OFF RAMP"—SPANS #221-#223—AUG. 9, 1936



FIFTH STREET PLAZA—AUG. 12, 1936



FIFTH STREET PLAZA — AUG. 12, 1936



S. F. APPROACH—SEPTEMBER 3, 1936



APPROACH—SPANS #1-#29—AUG. 20, 1936

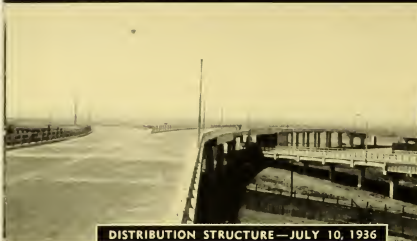


S. F. APPROACH—DEC. 1, 1936



S. F. APPROACH—DEC. 17, 1936

DISTRIBUTION STRUCTURE



DISTRIBUTION STRUCTURE—JULY 10, 1936



"N" LINE—SPANS #1-#7—JULY 10, 1936



DISTRIBUTION STRUCTURE—JULY 10, 1936



"N" LINE—SPAN #3—JULY 10, 1936

SAN PABLO UNDERPASS



SAN PABLO CROSSING—AUGUST 6, 1936



FINISHING CENTER CURB—AUGUST 6, 1936

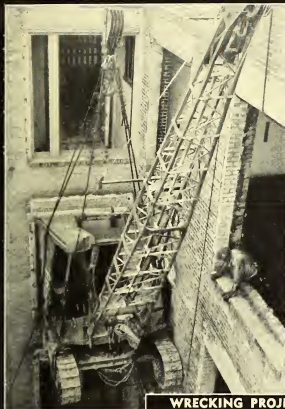


WEST APPROACH—AUGUST 6, 1936



WEST APPROACH—AUGUST 6, 1936

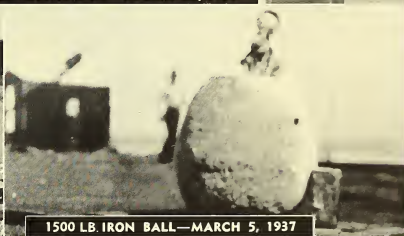
INTERURBAN CONSTRUCTION



WRECKING PROJECT—S. F. TERMINAL—CONT. R-1A—MARCH 30, 1937



IRON BALL IN ACTION—MAY 6, 1937



1500 LB. IRON BALL—MARCH 5, 1937

EAST BAY YARDS—CONTRACTS R-4 AND R-21



FOOTING FORMS—APRIL 20, 1937



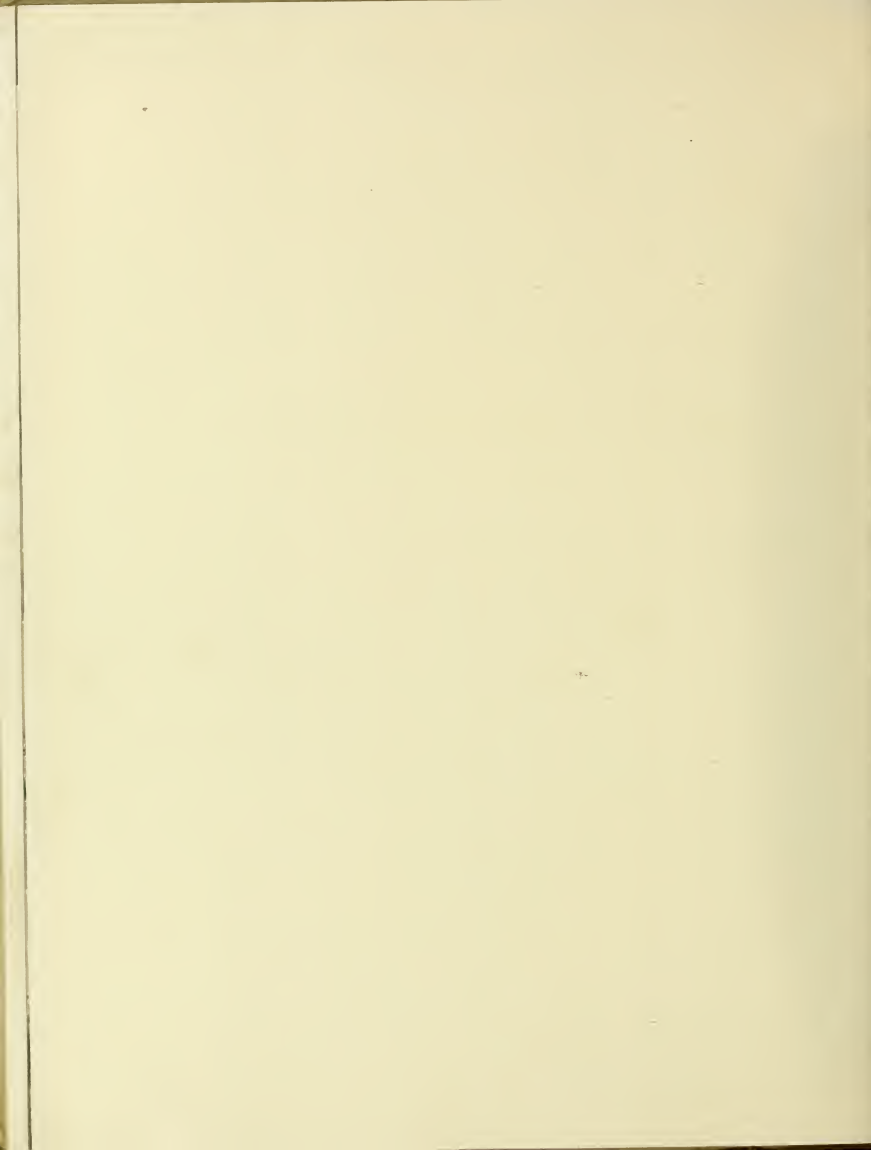
COFFERDAM S9, AFTER DRIVING—MAY 11, 1937



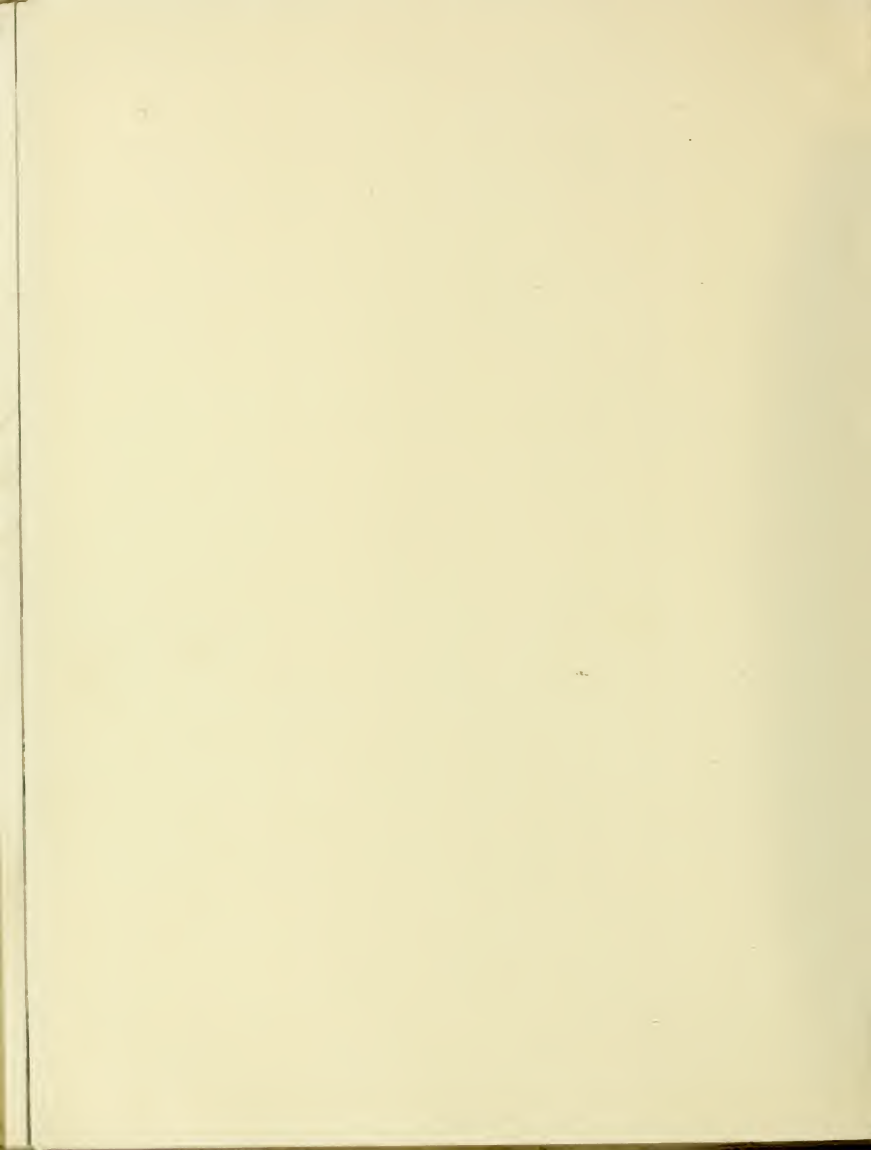
SPREADING FILL—MAY 11, 1937



A-C BULLDOZER—MAY 11, 1937



APPENDIX



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SAN FRANCISCO-OAKLAND BAY BRIDGE

TILE LINING-YERBA BUENA ISLAND
CONTRACT NO.13

Bids Opened
2:00 PM July 8 1936
Room 811 500 Sansome St. SF

TABULATION OF BIDS

SUPERIOR TILE CO. 3743 BROADWAY OAKLAND	MALOTT & PETERSON 2412 HARRISON SAN FRANCISCO	AMER. ART TILE CO. RIGNEY TILE CO. 3012 HARRISON OAKLAND	ART TILE-MANTEL CO. 221 OAK ST SAN FRANCISCO	DONLON FRATESSA 24 - 12 TH ST. SAN FRANCISCO
Bidders Bond \$ 6000 00 Certified Check	\$ 8000 00	\$ 7500 00	\$ 9000 00	\$ 7125 00

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT
1	50540	Square feet	Sand blasting	0605	3,057.67	0504	2,547.22	05	2,527.00	05	2,527.00	05	2,527.00
2	50540	Square feet	Tile Lining	103	52,056.20	1097	55,442.38	112	56,604.80	121	61,153.40	123	62,164.20
TOTAL					\$ 55,113.87		\$ 57,989.60		\$ 59,131.80		\$ 63,680.40		\$ 64,691.20

STATE OF CALIFORNIA
 DEPARTMENT OF PUBLIC WORKS
 SAN FRANCISCO-OAKLAND BAY BRIDGE
 TILE LINING-YERBA BUENA ISLAND
 CONTRACT NO. 13

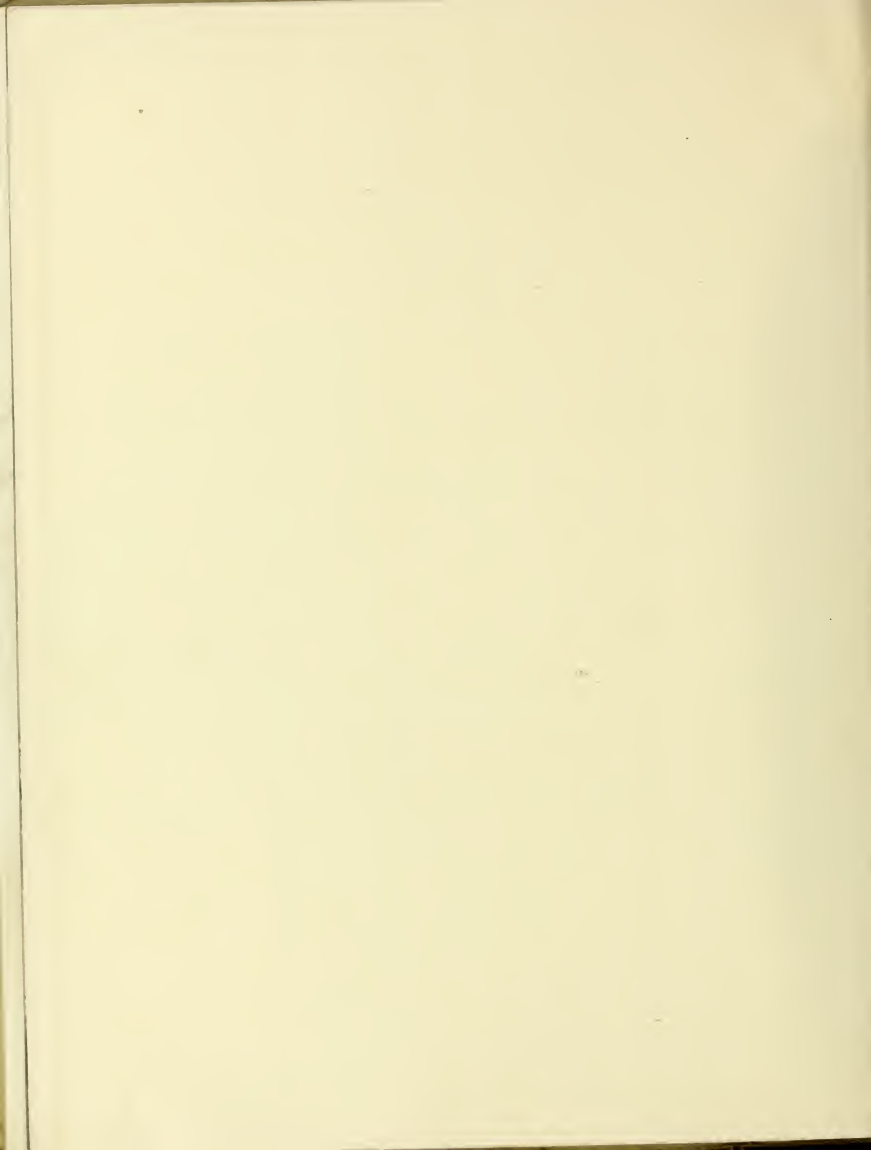
Job Number 2000-13
 Date July 9, 1952
 Location and Section 13

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
1	200.00	Square feet	Tile Lining	1.50	300.00
2	200.00	Square feet	Tile Lining	1.50	300.00
TOTAL					600.00

Approved: 6/1/52

State Engineer
 J. J. ...

7 5000-13



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

SAN FRANCISCO OAKLAND BAY BRIDGE

YERBA BUENA ISLAND GARAGE

CONTRACT NO. 14

Bids Open
2:00 P.M. Aug. 12, 1936
Room 811, 500 Sansome St., S.F.

TABULATION OF BIDS

ALFRED H VOGT
250 - 11th St
SAN FRANCISCO

EMPIRE CONST CO. LTD
405 RUSS BLDG
SAN FRANCISCO

WM C TAIT
883 MARKET ST
SAN FRANCISCO

M B MCGOWAN
504 CALL BLDG
SAN FRANCISCO

CLINTON CONST. CO.
923 FOLSOM ST.
SAN FRANCISCO.

Bidders
Bond
Certified
Check \$1500.00

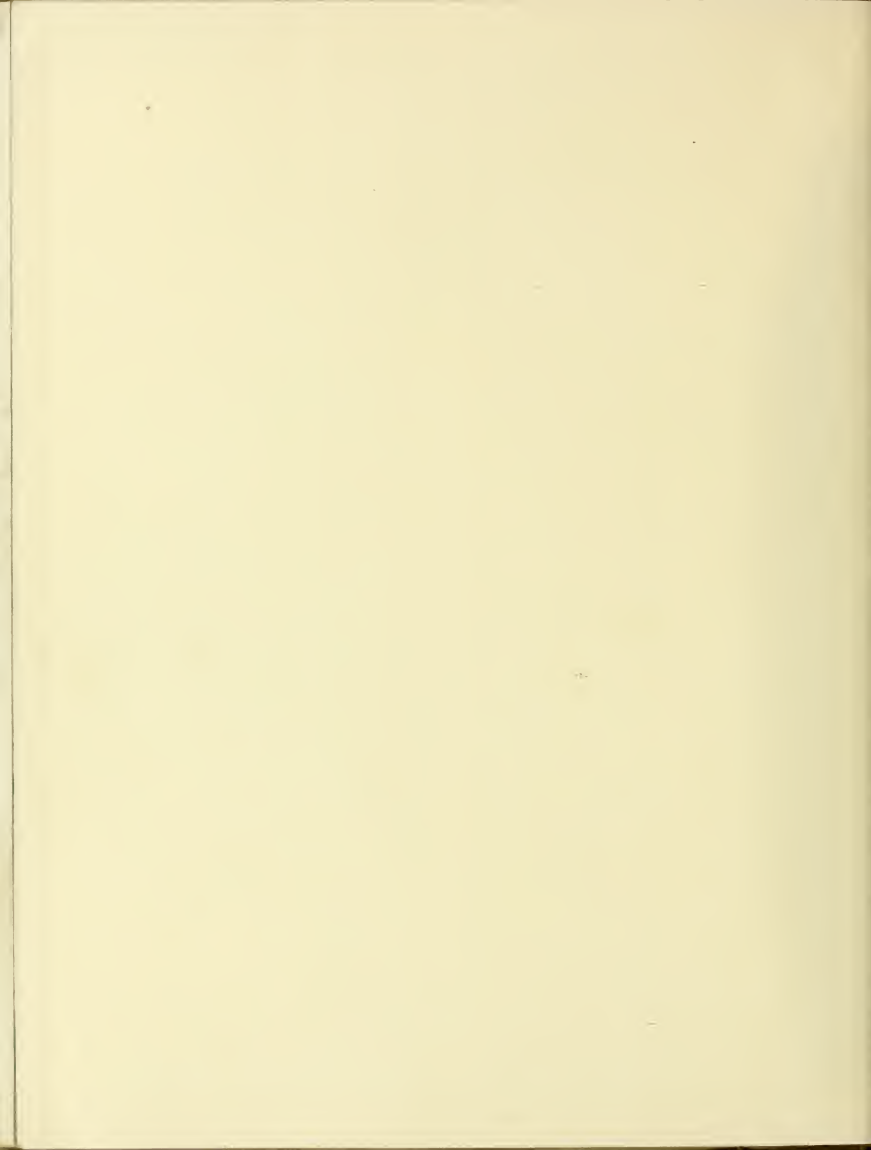
\$1700.00

\$1700.00

\$2000.00

\$3000.00

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT
1	360	Cubic Yards	Excavation	2.00	720.00	1.25	450.00	1.37	493.20	3.00	1080.00	2.00	720.00
2	190	Square Yards	Preparation of Subgrade	.20	38.00	.25	47.50	.66	125.40	.50	95.00	.20	38.00
3	40	Cubic Yards	Concrete Pavement, Curbs and Gutters	15.00	600.00	16.00	640.00	19.00	760.00	20.00	800.00	20.00	800.00
4			Building, General Construction (Lump Sum)		11,000.00		12,613.00		12,777.00		13,357.00		14,600.00
5			Plumbing (Lump Sum)		700.00		640.00		790.00		600.00		900.00
6			Electrical Work (Lump Sum)		1,200.00		1,300.00		1,520.00		1,000.00		1,500.00
7			Metal Lockers (Lump Sum)		175.00		99.00		125.00		100.00		100.00
8	50	Barrels	Extra Portland Cement	4.00	200.00	5.00	250.00	3.00	150.00	.50	125.00	2.40	120.00
TOTAL					\$14,633.00		\$16,199.50		\$16,740.60		\$17,157.00		\$18,778.00



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SAN FRANCISCO-OAKLAND BAY BRIDGE

Bids Opened
2 00 PM July 29, 1936
Room 811 500 Sansome St. S.F.

AUTOMATIC SPRINKLER SYSTEM IN HARBOR PIERS <u>NO. 24 AND NO. 26</u> CONTRACT NO. 18			TABULATION OF BIDS	
			GRINNELL CO. OF THE PACIFIC 601 BRANNAN ST. SAN FRANCISCO.	ROCKWOOD SPRINKLER CO. WORCESTER, MASS. AND 7 FRONT ST. SAN FRANCISCO.
			<i>Bidders Bond</i> \$15000 00	<i>Certified Check</i> \$12000 00
ITEM	QUAN.	DESCRIPTION	AMOUNT	AMOUNT
1	1 LOT	AUTOMATIC SPRINKLER SYSTEM	\$ 106,194.00	\$ 113,420.00
			\$ 106,194.00	\$ 113,420.00

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SAN FRANCISCO-OAKLAND BAY BRIDGE

WHEELS 2000
2000 2000 2000
2000 2000 2000

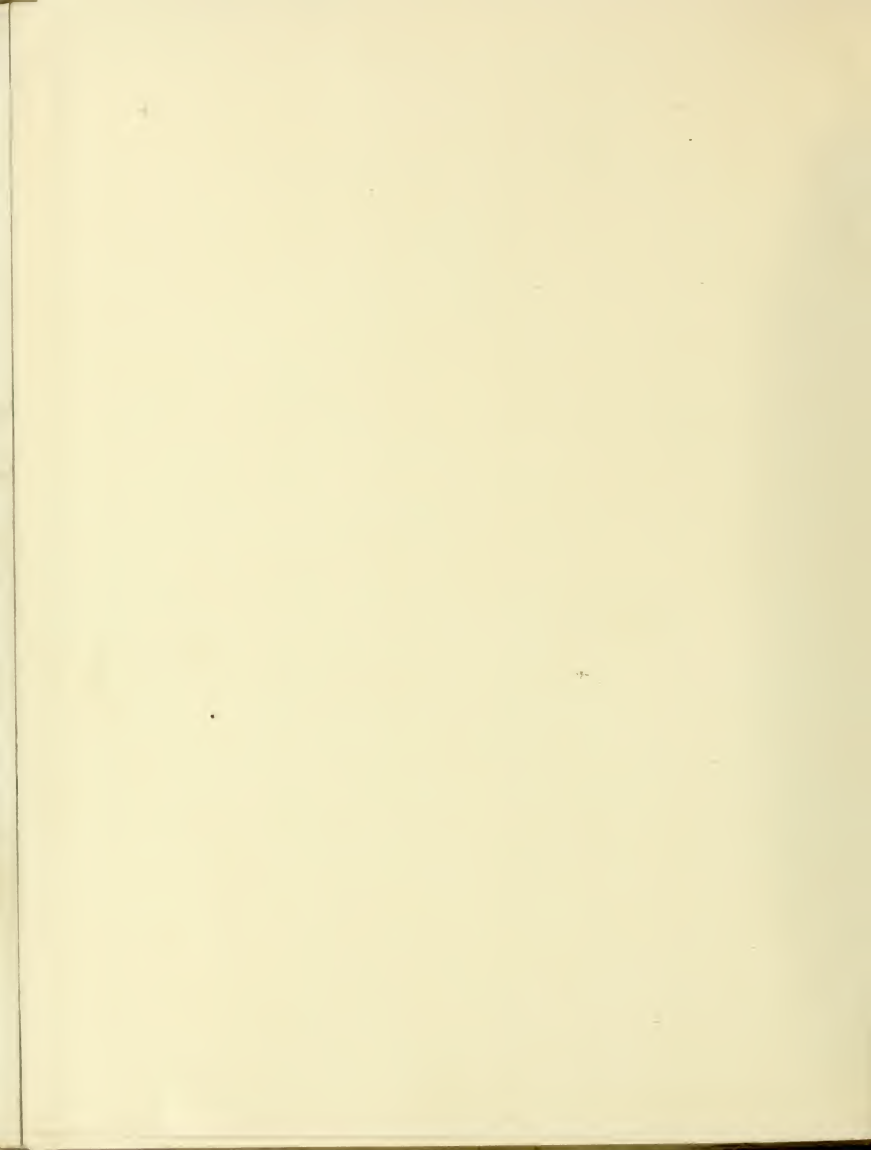
CONTRACT NO. 18 NO 24 AND NO 26 HARBOR PIERS SYSTEM IN SPRINKLER AUTOMATIC			TABULATION OF BIDS	
ITEM	QUAN	DESCRIPTION	AMOUNT	AMOUNT
1	1 LOT	AUTOMATIC SPRINKLER SYSTEM	\$ 106,194.00	\$ 113,430.00
			\$ 106,194.00	\$ 113,430.00

SAN FRANCISCO
AND FRONT ST
WORCESTER MASS
SPRINKLER CO
OF ROCKWELL

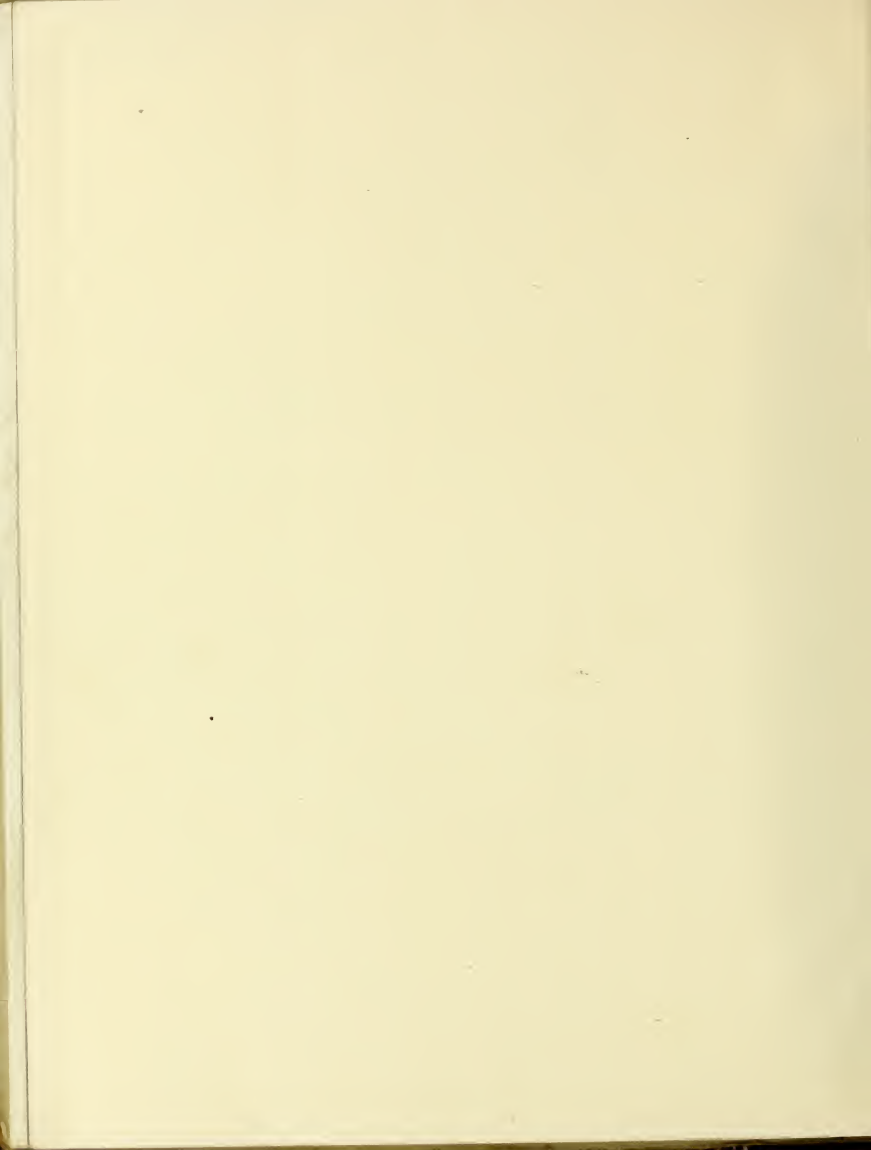
SAN FRANCISCO
801 BARNHART ST
THE PACIFIC
CHINELLE CO OF

21500000

21500000



Bids opened, 2:00 P.M.
November 25th 1936.
500 Sansome Street.
Rm. 811 San Francisco.



BIDS OPENED 2:00 P.M. JUNE 16TH 1937
Rm 811-500 SANDHOG ST. SAN FRANCISCO

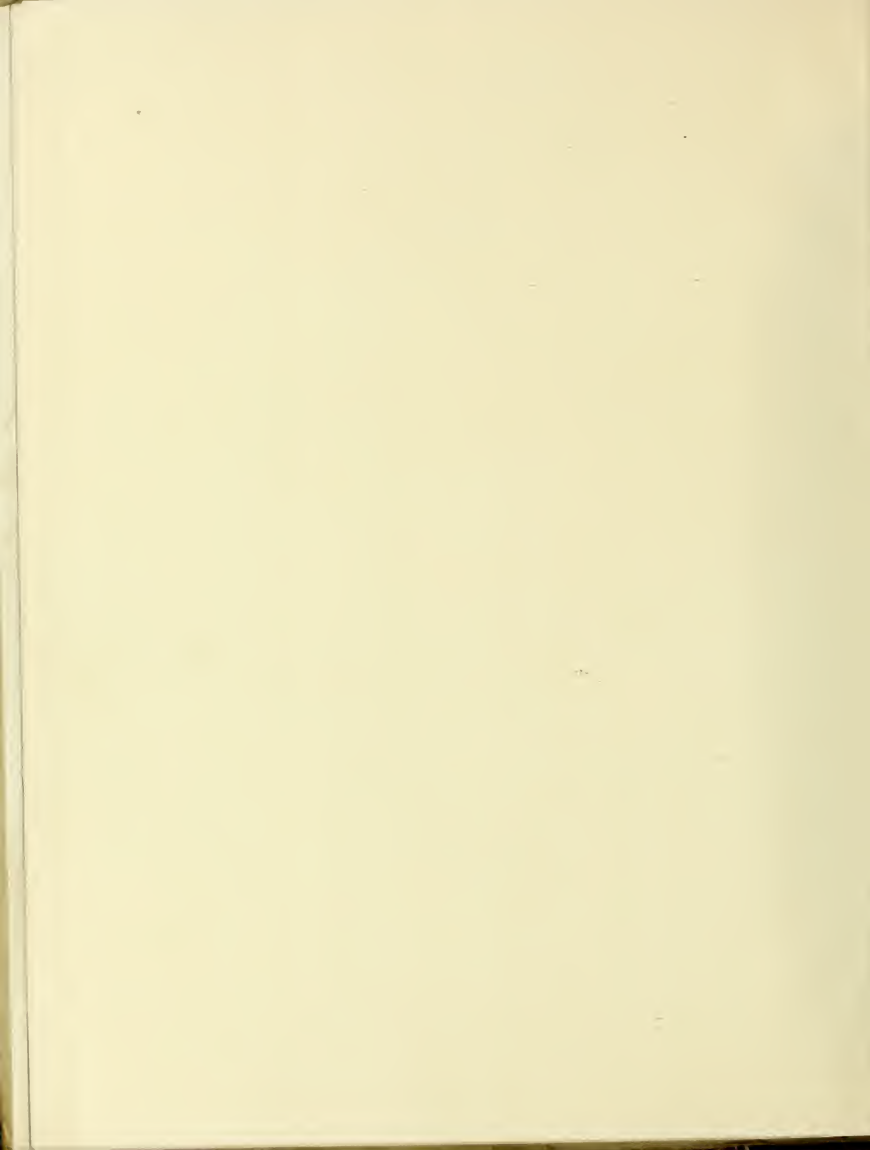
RAILWAY FACILITIES-----SAN FRANCISCO TERMINAL

CONTRACT R2A- GENERAL CONSTRUCTION
CONTRACT R2B- STRUCTURAL STEELWORK
CONTRACT R2C- MECHANICAL
CONTRACT R2D- ELECTRICAL

[illegible]

STATE OF CALIFORNIA
 SAN FRANCISCO - OAKLAND RAIL BRIDGE
 CONTRACT NO. 12345
 CONTRACTOR: JACOBSON & SONS
 CONTRACT NO. 12345
 CONTRACTOR: JACOBSON & SONS

DATE	DESCRIPTION	AMOUNT	CHECK NO.	PAID TO	REMARKS
1910	...	...	...	...	...
1911	...	...	...	...	...
1912	...	...	...	...	...
1913	...	...	...	...	...
1914	...	...	...	...	...
1915	...	...	...	...	...
1916	...	...	...	...	...
1917	...	...	...	...	...
1918	...	...	...	...	...
1919	...	...	...	...	...
1920	...	...	...	...	...
1921	...	...	...	...	...
1922	...	...	...	...	...
1923	...	...	...	...	...
1924	...	...	...	...	...
1925	...	...	...	...	...
1926	...	...	...	...	...
1927	...	...	...	...	...
1928	...	...	...	...	...
1929	...	...	...	...	...
1930	...	...	...	...	...
1931	...	...	...	...	...
1932	...	...	...	...	...
1933	...	...	...	...	...
1934	...	...	...	...	...
1935	...	...	...	...	...
1936	...	...	...	...	...
1937	...	...	...	...	...
1938	...	...	...	...	...
1939	...	...	...	...	...
1940	...	...	...	...	...
1941	...	...	...	...	...
1942	...	...	...	...	...
1943	...	...	...	...	...
1944	...	...	...	...	...
1945	...	...	...	...	...
1946	...	...	...	...	...
1947	...	...	...	...	...
1948	...	...	...	...	...
1949	...	...	...	...	...
1950	...	...	...	...	...
1951	...	...	...	...	...
1952	...	...	...	...	...
1953	...	...	...	...	...
1954	...	...	...	...	...
1955	...	...	...	...	...
1956	...	...	...	...	...
1957	...	...	...	...	...
1958	...	...	...	...	...
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1960	...	...	...	...	...
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1971	...	...	...	...	...
1972	...	...	...	...	...
1973	...	...	...	...	...
1974	...	...	...	...	...
1975	...	...	...	...	...
1976	...	...	...	...	...
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1978	...	...	...	...	...
1979	...	...	...	...	...
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1981	...	...	...	...	...
1982	...	...	...	...	...
1983	...	...	...	...	...
1984	...	...	...	...	...
1985	...	...	...	...	...
1986	...	...	...	...	...
1987	...	...	...	...	...
1988	...	...	...	...	...
1989	...	...	...	...	...
1990	...	...	...	...	...
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1992	...	...	...	...	...
1993	...	...	...	...	...
1994	...	...	...	...	...
1995	...	...	...	...	...
1996	...	...	...	...	...
1997	...	...	...	...	...
1998	...	...	...	...	...
1999	...	...	...	...	...
2000	...	...	...	...	...



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SAN FRANCISCO-OAKLAND BAY BRIDGE
BIDS OPENED 2:00 P.M. FEBRUARY 24, 1937
RM. 811-500 SANSOME ST., SAN FRANCISCO
RAILWAY FACILITIES
SUBSTRUCTURE EAST BAY YARD
CONTRACT N^o R4

TABULATION OF BIDS

APPROXIMATE QUANTITY		DESCRIPTION	BATES & ROGERS CONST. CO. 532 RUSS BUILDING SAN FRANCISCO BIDDER'S BOND \$ 80 000 00 CERTIFIED CHECK		J. F. KNAPP 1401 PARK AVE. OAKLAND \$ 80 000 00		BASICK BROS. 20530 SO. NORMANDIE AVE. TORRENCE, CAL. \$ 90 000 00		G.F. ATKINSON CO. 658 RUSS BUILDING. SAN FRANCISCO \$ 85 000 00		MACCO CONST. CO. 815 PARAMOUNT BLDE CLEARWATER, CALIF. \$ 93 000 00		CLINTON CONST. CO. OF CALIFORNIA 923 FOLSOM STREET SAN FRANCISCO \$ 100 000 00 \$ 20 000 00	
			UNIT PRICE	TOTAL	UNIT PRICE	TOTAL	UNIT PRICE	TOTAL	UNIT PRICE	TOTAL	UNIT PRICE	TOTAL	UNIT PRICE	TOTAL
EAST BAY YARD AND SOUTHERN PACIFIC CROSSING														
1	16,000	Cubic yards Excavation	2 30	36,800 00	75	12,000 00	2 00	32,000 00	2 00	32,000 00	3 60	57,600 00	6 35	101,600 00
2	20,000	Lineal feet creosoted timber Piles 40' to 59' long	1 09	21,800 00	1 25	25,000 00	1 07	21,400 00	1 70	34,000 00	1 35	27,000 00	2 00	40,000 00
3	25,000	Lineal feet creosoted timber Piles 60' to 79' long	1 19	29,750 00	1 15	28,750 00	1 16	29,000 00	1 75	43,750 00	1 35	33,750 00	1 85	46,250 00
4	35,000	Lineal feet creosoted timber Piles 80' or over	1 37	47,950 00	1 10	38,500 00	1 33	46,550 00	1 85	64,750 00	1 35	47,250 00	1 90	66,500 00
5	20,000	Lineal feet untreated timber Piles 40' to 54' long	53	10,600 00	60	12,000 00	58	11,600 00	95	19,000 00	1 10	22,000 00	1 55	31,000 00
6	30,000	Lineal feet untreated timber Piles 55' to 69' long	54	16,200 00	80	24,000 00	58	17,400 00	95	28,500 00	1 10	33,000 00	1 27	38,100 00
7	40,000	Lineal feet untreated timber Piles 70' to 84' long	57	22,800 00	75	30,000 00	64	25,600 00	95	38,000 00	1 15	46,000 00	1 16	46,400 00
8	87,000	Lineal feet untreated timber Piles 85' or over	62	53,940 00	70	60,900 00	71	61,770 00	1 05	91,350 00	1 00	87,000 00	1 00	87,000 00
9	6,400	Cubic yards Concrete in footings	8 25	52,800 00	12 00	76,800 00	14 00	89,600 00	12 00	76,800 00	17 00	108,800 00	18 80	120,320 00
10	1,700	Cubic yards Concrete above footings	18 15	30,855 00	18 00	30,600 00	27 18	46,206 00	33 00	56,100 00	24 55	41,735 00	21 40	36,380 00
11	1,400,000	Pounds Reinforcing Steel	0 46	64,400 00	0 475	66,500 00	05	70,000 00	0 45	63,000 00	05	70,000 00	0 48	67,200 00
12	80,000	Pounds Anchor Bolt Material	1 55	12,400 00	10	8,000 00	10	8,000 00	10	8,000 00	11	8,800 00	1 45	11,600 00
13	80	Thousand Feet Board Measure Timber untreated	67 00	5,360 00	55 00	4,400 00	88 03	7,042 40	60 00	4,800 00	88 00	7,040 00	77 00	6,160 00
14	880	Thousand Feet Board Measure Timber creosoted	122 00	107,360 00	110 00	96,800 00	120 00	105,600 00	95 00	83,600 00	116 00	102,080 00	124 00	109,120 00
15	62,000	Pounds Hardware (Timber)	1 09	5,580 00	10	6,200 00	10	6,200 00	08	4,960 00	10	6,200 00	10	6,200 00
16	2,600	Barrels Extra Portland Cement	23 7	6,162 00	2 25	3,850 00	2 75	7,150 00	1 80	4,680 00	2 40	6,240 00	2 00	5,200 00
		SUB-TOTAL		524,757 00		526,300 00		585,118 40		653,290 00		704,495 00		819,030 00
- PORT OF OAKLAND OVERHEAD -														
7	2,800	Cubic yards Excavation	5 5	12,740 00	5 00	14,000 00	2 00	5,600 00	2 00	5,600 00	4 50	12,600 00	8 35	23,380 00
8	8,000	Lineal feet untreated timber Piles 55' to 69' long	5 3	4,320 00	80	6,400 00	58	4,640 00	60	4,800 00	86	6,880 00	1 30	10,400 00
9	9,000	Lineal feet untreated timber Piles 70' to 84' long	5 5	5,130 00	75	6,750 00	64	5,760 00	60	5,400 00	92	8,280 00	1 20	10,800 00
10	70,000	Lineal feet untreated timber Piles 85' or over	6 6	43,400 00	70	49,000 00	71	49,700 00	60	42,000 00	1 00	70,000 00	1 20	84,000 00
11	1,750	Cubic yards Concrete in footings	9 0	15,837 50	12 00	21,000 00	12 75	22,312 50	12 00	21,000 00	16 35	28,612 50	16 80	29,400 00
12	1,600	Cubic yards Concrete above footings	18 9	30,240 00	18 00	28,800 00	28 83	46,128 00	18 00	28,800 00	19 20	30,720 00	21 50	34,400 00
13	600,000	Pounds Reinforcing Steel	0 1	25,800 00	0 45	27,000 00	0 49	29,400 00	0 4	24,000 00	0 475	28,500 00	0 45	27,000 00
14	20,000	Pounds Anchor Bolt Material	1 5	3,100 00	10	2,000 00	10	2,000 00	10	2,000 00	11	2,200 00	13	2,600 00
15	1,000	Cubic yards Rock Wall	9 10	9,100 00	5 00	5,000 00	3 50	3,500 00	4 00	4,000 00	13 50	13,500 00	7 60	7,600 00
16	5,000	Cubic yards Sand Fill	8 5	4,250 00	50	2,500 00	2 50	12,500 00	1 20	6,000 00	1 35	6,750 00	1 00	5,000 00
17	1,600	Tons Imported Base Material	1 00	1,600 00	1 25	2,000 00	75	2,800 00	1 00	1,600 00	3 00	4,800 00	1 30	2,080 00
18	800	Tons Crusher Run Base	2 00	1,600 00	2 50	2,000 00	2 25	1,800 00	2 00	1,600 00	3 50	2,800 00	2 75	2,200 00
19	400	Tons Asphalt Concrete	4 95	1,980 00	6 00	2,400 00	4 50	1,800 00	6 00	2,400 00	8 00	3,200 00	8 20	3,280 00
20	400	Barrels Extra Portland Cement	23 7	948 00	2 25	900 00	2 75	1,100 00	2 00	800 00	2 40	960 00	2 00	800 00
		SUB-TOTAL		160,045 50		169,750 00		189,040 50		150,000 00		219,802 50		242,940 00
		GRAND TOTAL		\$ 684,802 50		\$ 696,050 00		\$ 774,158 90		\$ 803,290 00		\$ 924,297 50		\$ 1,061,970 00

CONTRACT NO. 4
SUBSTRUCTURE EAST BAY YARD
RAILWAY FACILITIES
SAN FRANCISCO OAKLAND BAY BRIDGE
 DEPARTMENT OF PUBLIC WORKS
 STATE OF CALIFORNIA
 BIDS OPENED 1:00 P. M. FEBRUARY 24, 1917
 AT 1115 MARKET ST. SAN FRANCISCO

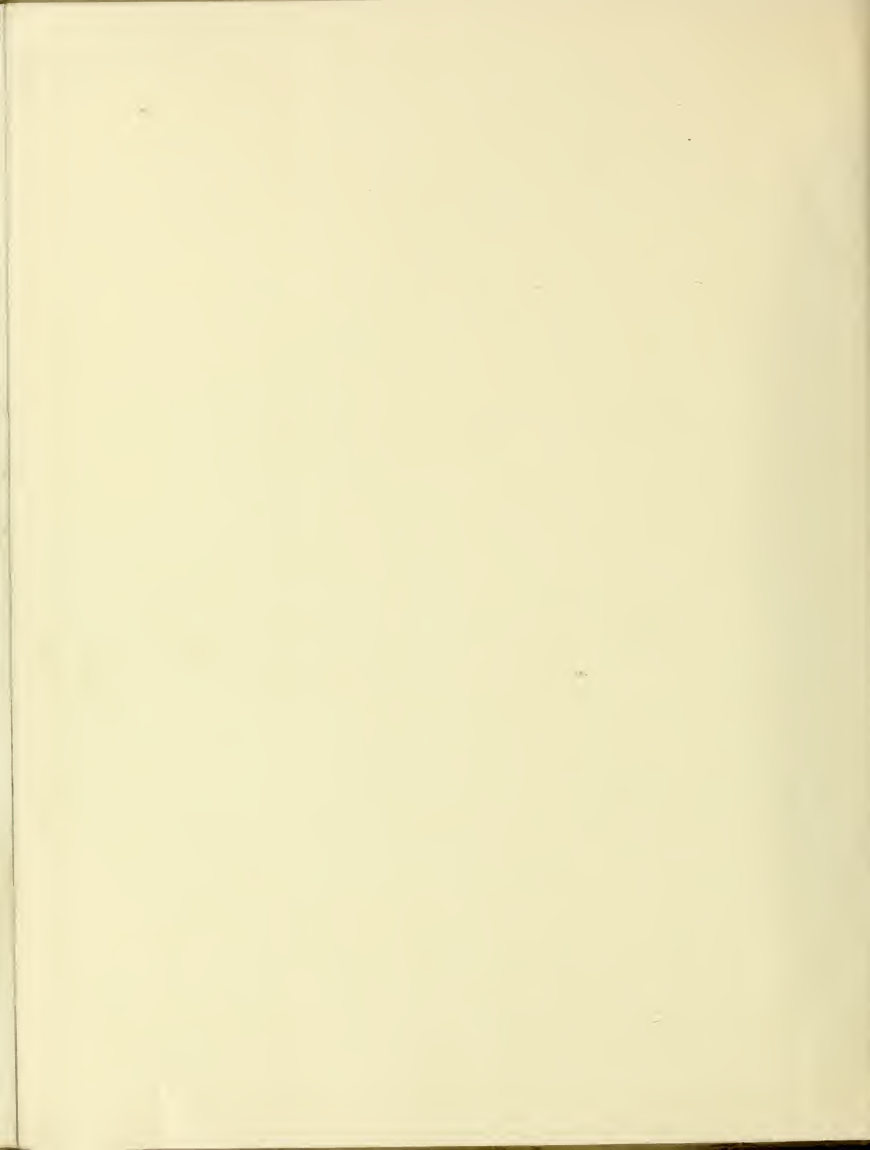
EAST BAY YARD AND SOUTHERN PACIFIC CROSSING
DESCRIPTION

1	Excavate and lay out foundations for 20 tracks	1000
2	Excavate and lay out foundations for 20 tracks	2000
3	Excavate and lay out foundations for 20 tracks	3000
4	Excavate and lay out foundations for 20 tracks	4000
5	Excavate and lay out foundations for 20 tracks	5000
6	Excavate and lay out foundations for 20 tracks	6000
7	Excavate and lay out foundations for 20 tracks	7000
8	Excavate and lay out foundations for 20 tracks	8000
9	Excavate and lay out foundations for 20 tracks	9000
10	Excavate and lay out foundations for 20 tracks	10000
11	Excavate and lay out foundations for 20 tracks	11000
12	Excavate and lay out foundations for 20 tracks	12000
13	Excavate and lay out foundations for 20 tracks	13000
14	Excavate and lay out foundations for 20 tracks	14000
15	Excavate and lay out foundations for 20 tracks	15000
16	Excavate and lay out foundations for 20 tracks	16000
17	Excavate and lay out foundations for 20 tracks	17000
18	Excavate and lay out foundations for 20 tracks	18000
19	Excavate and lay out foundations for 20 tracks	19000
20	Excavate and lay out foundations for 20 tracks	20000

PORT OF OAKLAND OVERHEAD
DESCRIPTION

1	Excavate and lay out foundations for 20 tracks	1000
2	Excavate and lay out foundations for 20 tracks	2000
3	Excavate and lay out foundations for 20 tracks	3000
4	Excavate and lay out foundations for 20 tracks	4000
5	Excavate and lay out foundations for 20 tracks	5000
6	Excavate and lay out foundations for 20 tracks	6000
7	Excavate and lay out foundations for 20 tracks	7000
8	Excavate and lay out foundations for 20 tracks	8000
9	Excavate and lay out foundations for 20 tracks	9000
10	Excavate and lay out foundations for 20 tracks	10000
11	Excavate and lay out foundations for 20 tracks	11000
12	Excavate and lay out foundations for 20 tracks	12000
13	Excavate and lay out foundations for 20 tracks	13000
14	Excavate and lay out foundations for 20 tracks	14000
15	Excavate and lay out foundations for 20 tracks	15000
16	Excavate and lay out foundations for 20 tracks	16000
17	Excavate and lay out foundations for 20 tracks	17000
18	Excavate and lay out foundations for 20 tracks	18000
19	Excavate and lay out foundations for 20 tracks	19000
20	Excavate and lay out foundations for 20 tracks	20000

DRAWN TOTAL
 TOTAL



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SAN FRANCISCO OAKLAND BAY BRIDGE

BIDS OPENED 2:00 P.M. DECEMBER 9, 1936
RM. 811-500 SANSOME ST., SAN FRANCISCO

RAILWAY FACILITIES
RAILWAY SIGNAL AND INTERLOCKING WORK

CONTRACT N° R5

TABULATION OF BIDS

GENERAL RAILWAY
SIGNAL CO.

ROCHESTER, N.Y.

RES. ENGR.

E. W. STONE,
315 PARK VIEW TERRACE
OAKLAND, CALIF.

UNION SWITCH &
SIGNAL CO.

SWISSVALE, PENN.

BIDDERS
BOND

\$ 175 000 ??

CERTIFIED
CHECK 140.000 ??

DESCRIPTION

AMOUNT

AMOUNT

1 RAILWAY SIGNAL AND INTERLOCKING WORK [WITHOUT "ALL-ROUTE"
INTERLOCKING CONTROL]-----

\$ 1,347,000 ??

\$ 1,390,000 ??

2 FOR "ALL ROUTE" CONTROL IN THE SAN FRANCISCO
INTERLOCKING.....LUMP SUM-----

6.672 ??

25,000 ??

3 FOR "ALL ROUTE" CONTROL IN THE OAKLAND
INTERLOCKING.....LUMP SUM-----

14,730 ??

40,000 ??

TOTAL OF 1, 2 & 3

\$ 1,368,402 ??

\$ 1,455,000 ??

STATE OF CALIFORNIA

DEPARTMENT OF PUBLIC WORKS

SAN FRANCISCO OAKLAND BAY BRIDGE

WORK ORDERED 200 P.M. DECEMBER 2, 1922
SAN FRANCISCO OAKLAND BAY BRIDGE

RAILWAY FACILITIES

RAILWAY SIGNAL AND INTERLOCKING WORK

CONTRACT NO. 2

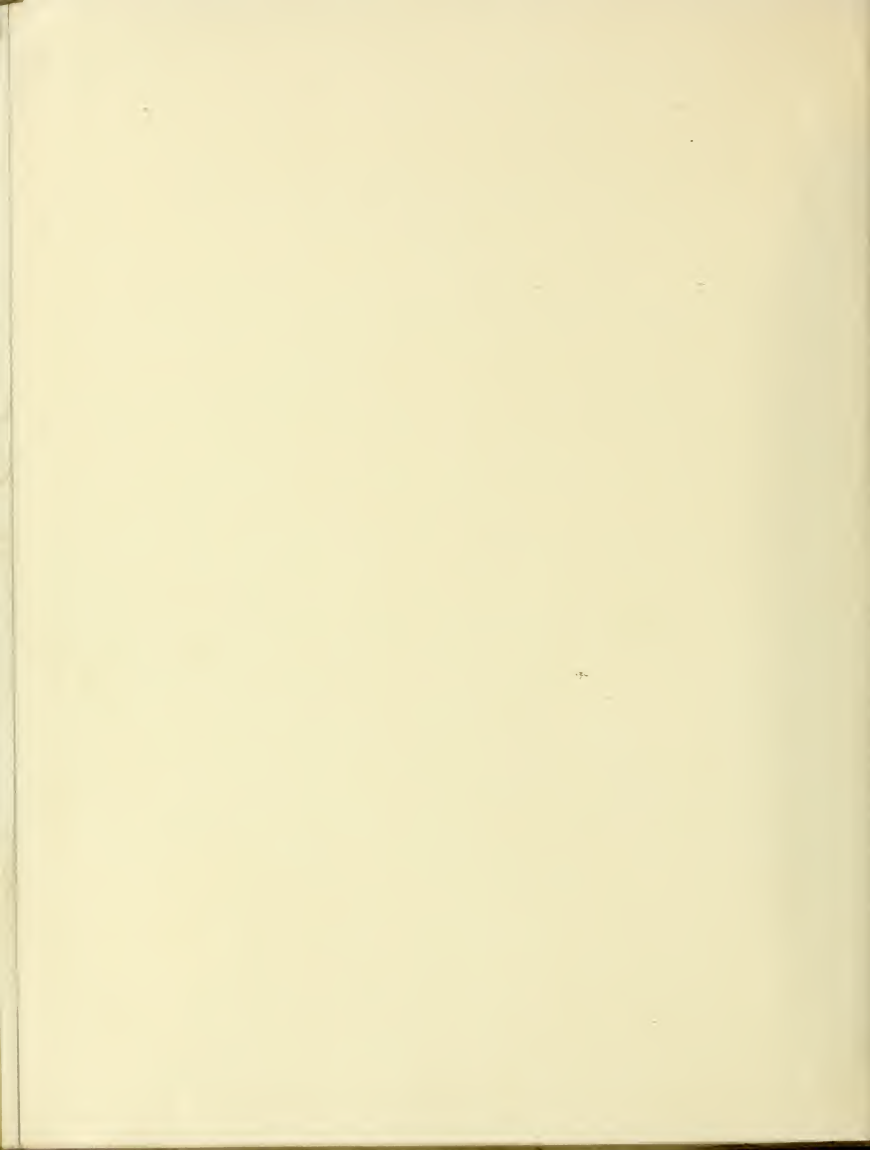
DESCRIPTION

1. RAILWAY SIGNAL AND INTERLOCKING WORK (WITHOUT ALL ROUTE
INTERLOCKING CONTROL)

2. FOR "ALL ROUTE" CONTROL IN THE SAN FRANCISCO
INTERLOCKING

3. FOR "ALL ROUTE" CONTROL IN THE OAKLAND
INTERLOCKING

TOTAL OF 1, 2 & 3



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
SAN FRANCISCO-OAKLAND BAY BRIDGE

BIDS OPENED 2:00 P.M. MARCH 31, 1937
RM. 811- 500 SAN SOME ST., SAN FRANCISCO

RAILWAY FACILITIES
SUPERSTRUCTURE EAST BAY YARD

CONTRACT N^o R7

ITEM	APPROXIMATE QUANTITY	DESCRIPTION
EAST BAY YARD AND SOUTHERN PACIFIC CROSSING		
1	1,310,000	Pounds Structural Steel in the S.P. Overhead and 26 th St. Crossing
2	1,400,000	Pounds Structural Steel in Catenary Bridge
3	800	Cubic Yards Concrete
4	160,000	Pounds Reinforcing Steel
5	30,000	Pounds Cast Steel Shoes
6	12,000	Pounds Pipe Railing
7	8	Thousand Feet Board Measure Timber
8	440	Tons Painting 26 th Street Crossing
9	230	Tons Painting Southern Pacific Overhead
10	700	Tons Painting Catenary Bridges
11	100	Barrels Extra Portland Cement
		SUB-TOTAL
- PORT OF OAKLAND OVERHEAD -		
12	1,700,000	Pounds Structural Steel
13	2,000	Cubic Yards Concrete
14	160,000	Pounds Reinforcing Steel
15	173,000	Lineal Feet Reinforcing Trusses
16	220,000	Pounds Pipe Railing
17	850	Tons Painting
18	200	Barrels Extra Portland Cement
		SUB-TOTAL
		GRAND - TOTAL

TABULATION OF BIDS

J.H.POMEROY				BARRETT & HILP				BATES & ROGERS CONSTRUCTION CO.				CLINTON CONSTR.OF CALIFORNIA				C.W.CALETTI			
333 MONTGOMERY SAN FRANCISCO.				918 HARRISON SAN FRANCISCO				532 RUSS BLDG. SAN FRANCISCO				923 FOLSOM ST. SAN FRANCISCO				P.O. BOX 243 SAN RAFAEL			
BIDDERS BOND \$ 60,000 ⁰⁰				\$ 60,000 ⁰⁰				\$ 54,809.90				\$ 60,000 ⁰⁰				\$ 75,000 ⁰⁰			
CERTIFIED CHECK																			
UNIT PRICE		TOTAL		UNIT PRICE		TOTAL		UNIT PRICE		TOTAL		UNIT PRICE		TOTAL		UNIT PRICE		TOTAL	
	077	100,870	00		082	107,420	00		077	100,870	00		085	111,350	00		0856	112,136	00
	0925	129,500	00		10	140,000	00		093	130,200	00		103	144,200	00		10	140,000	00
19	00	15,200	00	22	00	17,600	00	26	75	21,400	00	22	50	18,000	00	20	00	16,000	00
	05	8,000	00		05	8,000	00		055	8,800	00		058	9,280	00		05	8,000	00
	18	5,400	00		20	6,000	00		24	7,200	00		185	5,550	00		25	7,500	00
	15	1,800	00		25	3,000	00		27	3,240	00		285	3,420	00		50	6,000	00
120	00	960	00	100	00	800	00	115	00	920	00	100	00	800	00	200	00	1,600	00
8	00	3,520	00	8	00	3,520	00	7	20	3,168	00	7	50	3,300	00	10	00	4,400	00
8	00	1,840	00	8	00	1,840	00	7	20	1,656	00	7	60	1,748	00	10	00	2,300	00
8	00	5,600	00	13	00	9,100	00	11	20	7,840	00	7	60	5,320	00	10	00	7,000	00
2	30	230	00	2	50	250	00	2	50	250	00	1	50	150	00	3	00	300	00
		272,920	00			297,530	00			285,544	00			303,118	00			305,236	00
	076	129,200	00		07	119,000	00		075	127,500	00		075	127,500	00		08	136,000	00
24	00	50,400	00	21	00	44,100	00	24	75	51,975	00	20	00	42,000	00	20	00	42,000	00
	05	8,000	00		046	7,360	00		0475	7,600	00		045	7,200	00		05	8,000	00
	26	44,980	00		213	36,849	00		22	38,060	00		22	38,060	00		25	43,250	00
	11	24,200	00		12	26,400	00		14	30,800	00		145	31,900	00		20	44,000	00
8	00	6,800	00	7	00	5,950	00	7	20	6,120	00	7	00	5,950	00	10	00	8,500	00
2	30	460	00	2	50	500	00	2	50	500	00	1	50	300	00	3	00	600	00
		264,040	00			240,159	00			262,555	00			252,910	00			282,350	00
		\$ 536,960	00			\$ 537,689	00			\$ 548,099	00			\$ 556,028	00			\$ 587,586	00

